SEPTEMBER 1960

Utility engineering section begins on page 49

Electrical South

SOUTHERN MAGAZINE OF ELECTRICAL CONSTRUCTION

Serving the 18 Southern and Southwestern States

How time-saving tools and methods speed electrical work on the mammoth State Department Building job.

See page 34

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...in accurate machining
...in smooth-fitting threading

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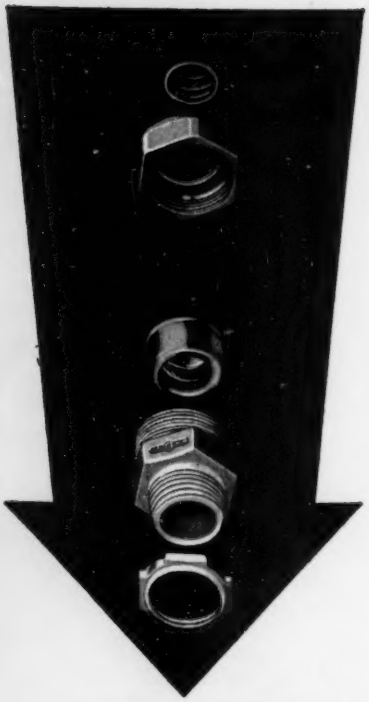

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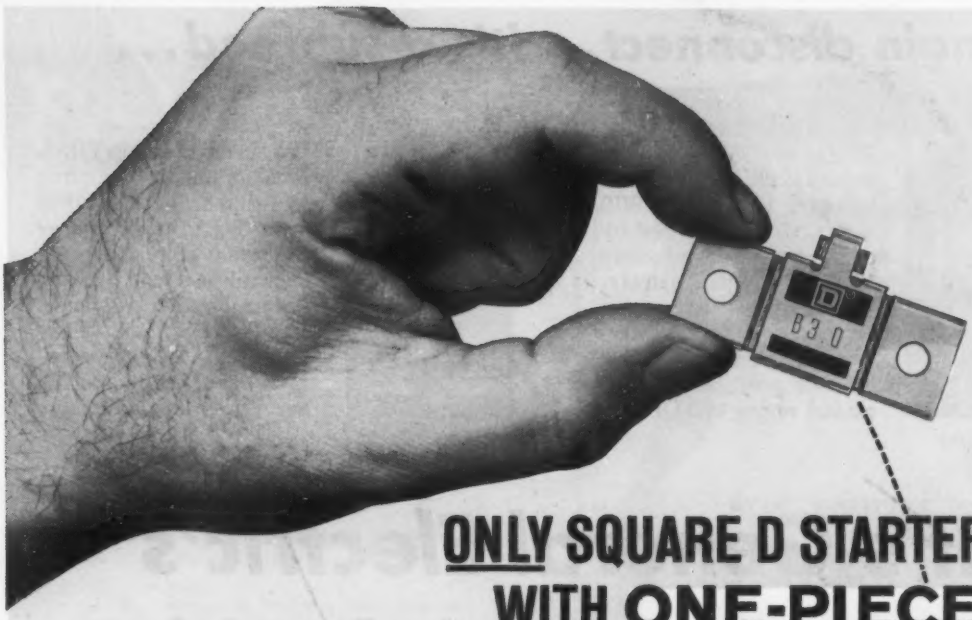

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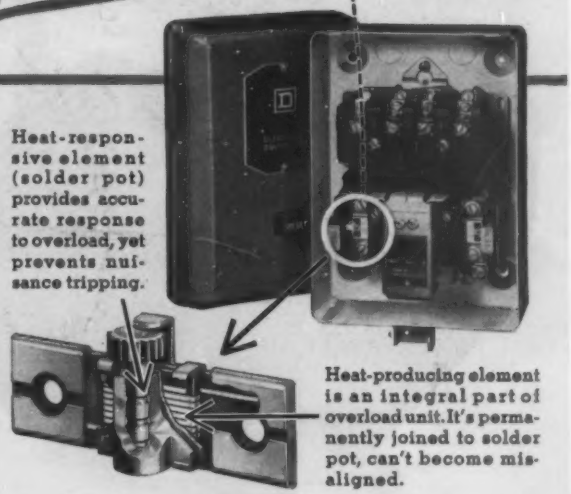

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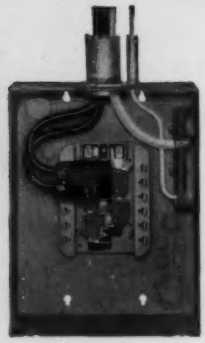

Plug in new TQAL breaker in usual manner on load centers rated 125-200 amps, then *backfeed* by connecting line conductors to breaker terminals. TQAL now acts as main disconnect for entire service; current to remaining breaker positions cannot exceed rating of TQAL.

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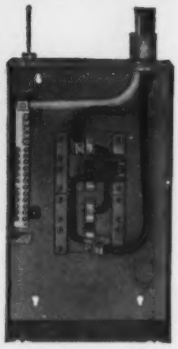

Plug in new 70-amp TQAL breaker on devices rated 125-200 amps; new 100-amp TQAL on devices rated 200 amp, then connect subfeed load conductors to breaker terminals. The TQAL is now a "SUB-FEED MAIN" for separate branch controlling heat pump, heat panel, etc.

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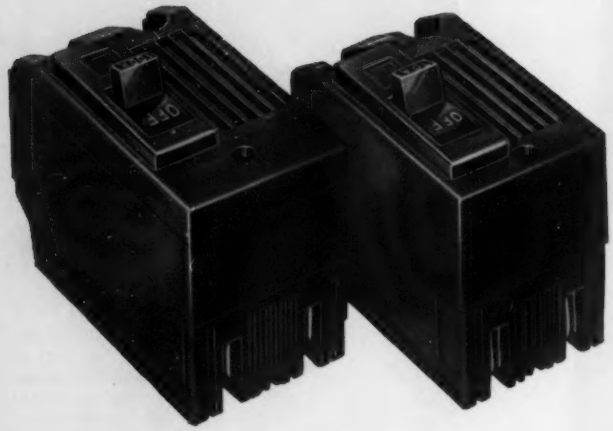

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In G-E load centers rated 125 amperes and above, these new TQAL breakers will bring you real savings wherever main disconnects are required. Write for Bulletin GEA-7071.

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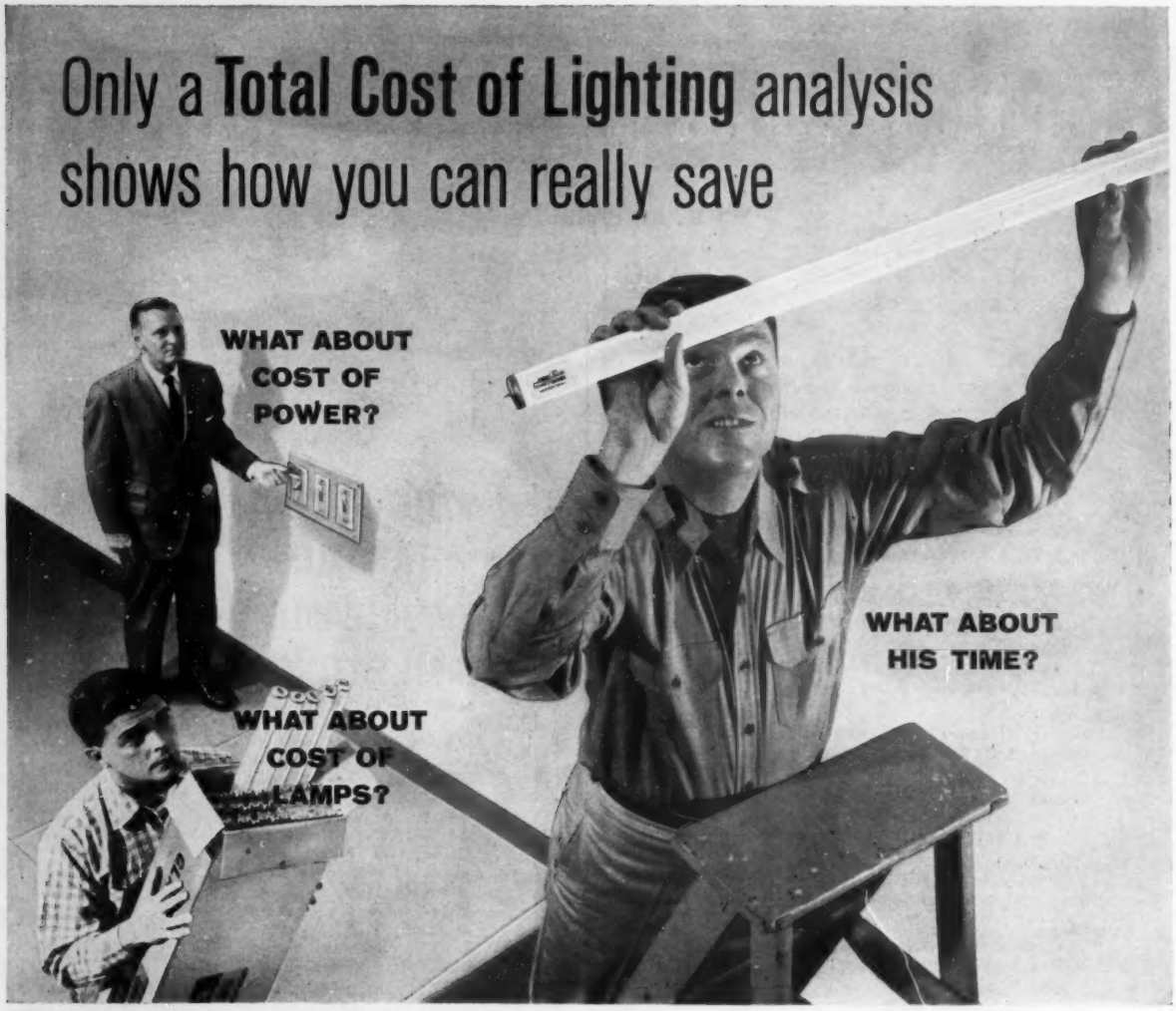
Only a **Total Cost of Lighting** analysis shows how you can really save



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Subsidiary of **GENERAL TELEPHONE & ELECTRONICS**

Electrical South

Vol. 40, No. 9 Sept. 1960

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*Omitted this month.

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Economic comment

by J. Whitney Bunting, Ph.D.
Contributing Economics Editor

Good example of consumer motivation

One of the weakest spots in the American economy to date is that of major electrical appliances. Practically every manufacturer of such equipment has been forced to reassess production schedules, even to the extent of some personnel layoffs, because of slow and spotty demand for many of these consumer durable items.

In many instances, this trend has been in direct contrast to rather well substantiated market surveys that indicated a steady market for major household equipment items. All indicators that can be used to foretell the ability of consumers to buy appliances such as employment, disposable personal income, stock of savings, housing starts, scrappage rates of presently owned appliances, new family formations, birth rates, and many others show a steadily increasing market potential for most items even though the national economy has achieved a near saturation point for some.

What is not foretold by the forecasts, however, is that very important factor encountered in the competitive enterprise system which is the right and privilege of every consumer to exercise free choice in the market place when spending his money.

On the basis of the best studies available, none of which can be assumed to be letter-perfect, this choice is being exercised not only between competing brands of relatively high cost appliances, but also between the actual purchase of appliances and other potential fund uses.

For example, many families have decided on a "make-do" philosophy as far as appliances are concerned, and they are moving into expenditures for foreign travel, previously considered to be a luxury for most people. In fact, it is highly probable that air line advertising that proclaims the advantages and beauties of worldwide travel has done much to encourage family trips abroad and the postponement of appliance purchases that might have had first preference earlier. Americans have become extremely travel conscious of late, and, for most, this creates a financial decision because of limited budgets.

Dr. Bunting is a well-known economist and educator having special knowledge of the South.

Will the 'Sixties live up to promises?

Another factor that has been touched upon in this column before has been the inability of the national economy to live up to some of the glamorous predictions made for the current decade. True only eight months have passed, but many people have been led to believe that January 1960 marked the beginning of a glittering era of high incomes and wealth aplenty. Unfortunately, such conditions must be cold-watered and do not happen overnight.

The fact that some economic regions have been somewhat less than normal in activity has created a feeling of pessimism about the outcome of the economics of the Sixties. Continued cold war pressures, international unrest, political remarks often intemperate in nature, and continued spotty unemployment have all contributed to a public apathy in the major appliance market place.

It does not matter greatly that these factors noted (and others as well) are of limited importance in the face of many strong forces pushing the economy forward. Little attention is paid to the fact that such forces must be vigorous if even to hold the economy at the slow pace of advance that is preponderant at the present time. Consumers do absorb such ideas in their minds, however, and when major buying decisions are to be made, they often postpone the purchase to a later date.

Thus, all of this foretells an upsurge of buying of major appliances in the future. Market research is certainly correct in its interpretation of needs. And the needs should certainly grow along with future improvements on the economic scene along with American desires for better and better products for good living.

It should be up to American industry and the distributors to forcefully build a climate whereby major financial decisions can be made by consumers on a factual basis, rather than under the blanket of questionable economic dangers. This can be done only when business leadership adopts a vigorous program of research into human behavior and motivation along with continuous analysis of economic trends.

Acceptance gaining for motivation research

At the present time, much of the human behavioral research is carried on under college and university auspices. Two factors are responsible for this; first, industry itself has been slow in accepting the idea that an understanding of human behavioral reactions is a part of the science of business. Second, most of those persons trained in such research and its interpretation find most sympathetic understanding on the campus and thus hesitate to move away from such surroundings into the business community.

Fortunately, some of the major industries are slowly moving into an acceptance of such research particularly in the areas of management of people. There are many further business interpretations possible, however, and perhaps the greatest potential lies in techniques of reaching consumers. Under proper circumstances, behavioral research could well overcome the present failures to forecast consumer activity in an adequate manner.

Sound behavioral research coupled with more refined techniques of economic forecasting could be an unbeatable combination for the marketing of durable consumer

(Continued on page 132)

The men who really know...know Efcor

UNIVERSITY HALL, University of Calif., Berkeley

Meet Jim Mahaney, seasoned veteran of 22 years in the electrical construction field . . . superintendent for the Coopman Electric Company; contractors specializing in complex commercial and industrial electrical installations. Jim, who has supervised some of the most interesting jobs in the West, insists on quality products . . . like those manufactured by Efcor, for a trouble free job.

For instance, in the University of California's new University Hall, Jim and his men have used Efcor fittings and boxes in an installation that they will be proud of for years. Men like Jim Mahaney take pride in their work **. . . the men who really know— know Efcor.**

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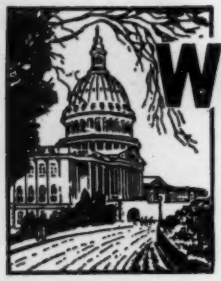


Washington report

By Jack James

Digest of Washington news of special interest to the electrical industry

Electric heat shows increase

MORE ELECTRIC HEAT equipment will be sold in the U. S. in 1960 than in any year in history, the U. S. Department of Labor predicts.

The Department says that 1959 was "undoubtedly the best year to date for electric heating equipment because of the increased promotional activity," and the Department says that 1960 should be better.

With promotion by manufacturers and power companies and with lower electric rates for heating, "electric heating equipment will become increasingly competitive with other types of heating equipment in the ensuing years," the Department states.

The Department devoted two pages of its monthly publication *Construction Review* to an article entitled "New Statistics on the Electric Heating Industry." The article concerned itself with "electric heating equipment which is permanently attached and an integral part of a building structure. All types of portable electric heaters are excluded."

In 1959 the $28 million in sales of electric heating equipment amounted to 7 per cent of all sales of heat - producing equipment. During the year, $8.3 million worth of baseboard heaters were sold, $5.6 million of unit heaters and ventilators, $5.6 million of convectors without fans, $4.3 million of convectors with fans, $1.4 million of radiant glass panels, $1.1 million of cable systems fabricated as units, $0.6 million of baseboard glass panels, $0.5 million cable systems only, $0.2 million warm air furnaces wall type $51,000 warm air floor furnaces, and $89,000 warm air central furnaces.

The large sales of baseboard radiation equipment apparently followed "the upward trend of baseboard radiation utilized in the wet-heat systems," the Labor Department said.

"Although the principal market for electric heat is in new-home construction and rehabilitation of existing dwellings, it is adaptable for use in commercial structures," the Department said. "Unit heaters are used mainly in commercial and industrial installations. Unit ventilators are primarliy used in commercial and school construction."

Of the $27 million worth of heating equipment shipped last year, $2.9 million went to the South Atlantic region of the U. S., $3.7 million to the East South Central, $1.4 million to the West South Central, making the Southern region by far the greatest user of electric heat.

29 states permit time off to vote

WITH ELECTIONS up coming in November, you can find out whether your state has a time-off-for-voting law from a new pamphlet published by the U. S. Department of Labor. According to the pamphlet, 29 states do permit employees to take time off to vote during working hours.

Seventeen of these states prohibit deduction of pay. Thirteen states specify that employees must apply in advance for time off to vote, and some states let the employer set the time.

For a free copy of this pamphlet write the Bureau of Labor Standards, U. S. Department of Labor, Washington 25, D. C. Ask for *Time Off for Voting Under State Laws.*

Gulf contractors sign new pact

MEMBERS of the Gulf Coast Chapter of the National Electrical Contractors Association agreed to raise pay of journeymen electricians 12½ cents an hour in pacts with IBEW locals at Gulfport, Miss., and Mobile, Ala.

A one-year contract renewal with Local 903 at Gulfport raised pay to $3.52½ an hour for journeymen. Foremen get 30 cents an hour more, and general foremen 60 cents an hour more. Cable splicers are paid 25 cents above the journeyman's rate.

In a two-year renewal with Mobile electricians, the NECA agreed to raise pay 12½ cents this year and 12½ cents next year. New rate for journeymen is $3.85 an hour. Cable splicers get a 25-cent premium; foremen are 10 per cent above the journeyman's rate; area foremen, 17½ per cent above the journeyman's rate; and general foremen, 25 per cent above. The 10-cent hourly health - welfare coverage payment continues.

Construction will hold at 1959 rate

NEW CONSTRUCTION should total $55.8 billion in 1960, the U. S. Department of Commerce predicts in its mid-year look at the construction industry. This is about the same as the record set in 1959 and about 10 per cent above 1958.

Increases in almost all types of construction except housing will be offset by a $2 billion drop in public and private new housing.

Here is the Department's analysis by categories:

Housing—1,325,000 private units and 35,000 public units, totaling 1,360,000 units compared with 1,553,100 units in 1959. "A more plentiful volume of mortgage money is foreseen at this time, compared to 9 months ago, and further improvement in the rate of private housing construction beyond 1960 is anticipated."

Private Construction (other than residential) — Should reach $10 billion level for first time. Industrial construction up from $2.1 billion last year to $2.7 billion this year. Commercial construction at $4 billion well over 1959 peak. Public utility electric power construction will be down.

Public Construction — Drop in federal expenditures is chiefly responsible for decline from $16.2 billion to $16 billion.

Nashville school job boycott held illegal

A SECONDARY boycott organized by IBEW Local 429 against Sam Melson, general contractor, at a Nashville, Tenn., school was

(Continued on page 138)

Last year, traffic accidents killed 37,000, injured 1,400,000

. . . and they wasted Five Billion Dollars!

Traffic accidents' human toll is so tragic we sometimes overlook their staggering economic waste. Five Billion Dollars in lost wages, medical expenses, insurance costs and property damage! Your business—every business—shares in this loss. So you have a double interest in helping reduce traffic accidents. And you *can* help! Drive safely and obey the law yourself . . . certainly. But go further. Use your influence to promote safe driving and urge strict law enforcement. To make your efforts more effective, join with others working actively to reduce traffic hazards in your community. *Support your local Safety Council!*

Published in an effort to save lives, in cooperation with the National Safety Council and The Advertising Council.

CATALOGS and BULLETINS

Available Free to Readers of Electrical South upon Request

LIGHTING PANELBOARDS — A 4-page descriptive folder featuring a line of plug fuse and toggle switch panelboards for lighting control circuits is now available from Frank Adam Electric Co., 3650 Windsor Pl., St. Louis, Mo. The folder includes box sizes, details of construction, wiring gutters, special features, and catalog numbers.

Write in No. D100 on card, pg. 17

CIRCUIT PROTECTION — A 24-page illustrated handbook contains suggestions for selecting the right kind of protection for electric circuits, motors, appliances and apparatus. Includes motor wiring diagrams and a complete list showing proper size fuses to use. Available from Bussman Mfg. Co., University at Jefferson, St. Louis 7, Mo.

Write in No. D102 on card, pg. 17

MODULAR LIGHTING—A twelve-page folder describing and illustrating their line of surfaced and recessed fluorescent modular fixtures is announced by Moe Light of Thomas Industries Inc., Lighting Division, Brook & Broadway, Louisville, Ky. Complete coefficient of utilization and candlepower distribution tables are included for each set of fixtures.

Write in No. D104 on card, pg. 17

MANHOLE HEATER — A four-page brochure issued by Morrison-Pelsue Co., 2001 S. Bannock St., Denver 23, Col., describes and illustrates applications of the MoPeCo Ventilating Heater available in several models, electrical or gasoline engine powered.

Write in No. D105 on card, pg. 17

HYDRAULIC POWER TOOLS—A new bulletin describing their two-speed, fast-approach portable power unit for hydraulic tools such as conduit benders, cable pullers, and pipe pushers is announced by Greenlee Tool Co., Rockford, Ill.

Write in No. D108 on card, pg. 17

CONDUIT WIREHOLDERS — A new information sheet describing their line of all-purpose conduit wireholders is now available from Knox Porcelain Corp., P. O. Box 2031, Knoxville, Tenn. The illustrated sheet gives installation information, design features, and specifications.

Write in No. D109 on card, pg. 17

LAMP GUIDES—Sylvania Lighting Products, 60 Boston St., Salem, Mass., has made available three lamp guides containing general information, technical data, and catalog listings on their lines of fluorescent lamps, incandescent lamps, and mercury lamps.

Write in No. D110 on card, pg. 17

PLUGS, RECEPTACLES — Two basic designs — explosion-proof and weatherproof—of Killark plugs and receptacles are fully covered in a new catalog section. This line offers many advantageous features, and is available in many styles and sizes to fit various boxes. Killark Electric Mfg. Co., Easton and Vandeventer Ave., St. Louis 13, Mo.

Write in No. D111 on card, pg. 17

ELECTRICAL DEVICES — Two publications, the pocket Federalog 111-PR and Bulletin 3-230, have been made available by Federal Pacific Electric Co., 50 Paris St., Newark, N. J. Complete details concerning circuit breakers, panelboards, fusible service equipment, safety switches, industrial motor control and lighting and power panelboards are contained in the 32-page pocket-sized catalog. The 8-page bulletin is devoted to the company's new line of QMQB fusible switches and panelboards.

Write in No. D112 on card, pg. 17

BUILT-IN HEATERS—Thermador Electrical Manufacturing Co., 5119 District Blvd., Los Angeles 22, Calif., has announced the availability of three new catalog sheets on their line of built-in electric heaters. The heaters described are their portable radiant-fan heater, electric ceiling heater, and baseboard electric heater.

Write in No. D113 on card, pg. 17

PRICE SERVICE—Specimen copies of the National Price Service price books are available on request from Henderson-Hazel Corp., 13601 Euclid Ave., Cleveland 12, Ohio. Please indicate whether you are a contractor or wholesaler. Each specimen includes a complete index, a representative sampling of completely illustrated price sheets, and information of special interest to those concerned with pricing electrical construction materials.

Write in No. D114 on card, pg. 17

FLUORESCENT FIXTURES—The new Miller Sabre fluorescent fixture is illustrated in the Sabre catalog, page 13, published by The Miller Company, Meriden, Conn. This page points out application, construction details, and dimensional, illumination, and installation data.

Write in No. D115 on card, pg. 17

CABLE SUPPORTING TRAYS—The Globe Co., 4000 South Princeton Ave., Chicago 9, Ill., has made available a new catalog on their line of cable supporting tray systems and accessories. The catalog contains information on design features, specifications, and installation.

Write in No. D116 on card, pg. 17

CENTRIFUGAL ROOF VENTILATORS—An 8-page, two-color folder (SDA-220) gives construction features, performance data, dimensions and recommended specifications for the new Centrifugal Roof Ventilator manufactured by The Peerless Electric Company, Warren, Ohio. Other important Peerless Fan and Blower products and a list of Peerless sales representatives are also included.

Write in No. D117 on card, pg. 17

ELECTRICAL FITTINGS—A 30-page illustrated catalog and price list of electrical fittings is now available from the Bridgeport Fittings, Inc., 209 Center St., Bridgeport, Conn. The catalog is loose-leaf type and contains complete ordering data for the wide range of fittings and devices in this line.

Write in No. D118 on card, pg. 17

SPACE HEATING GUIDE—Cavalier Corp., Chattanooga 2, Tenn., has prepared a Guide for Calculations on Electric Space Heating. It is based on a study of several thousand installations of electric heat and is a handy reference for calculating electric heating requirements and estimating operating costs. The booklet contains discussion, charts and floor plan examples.

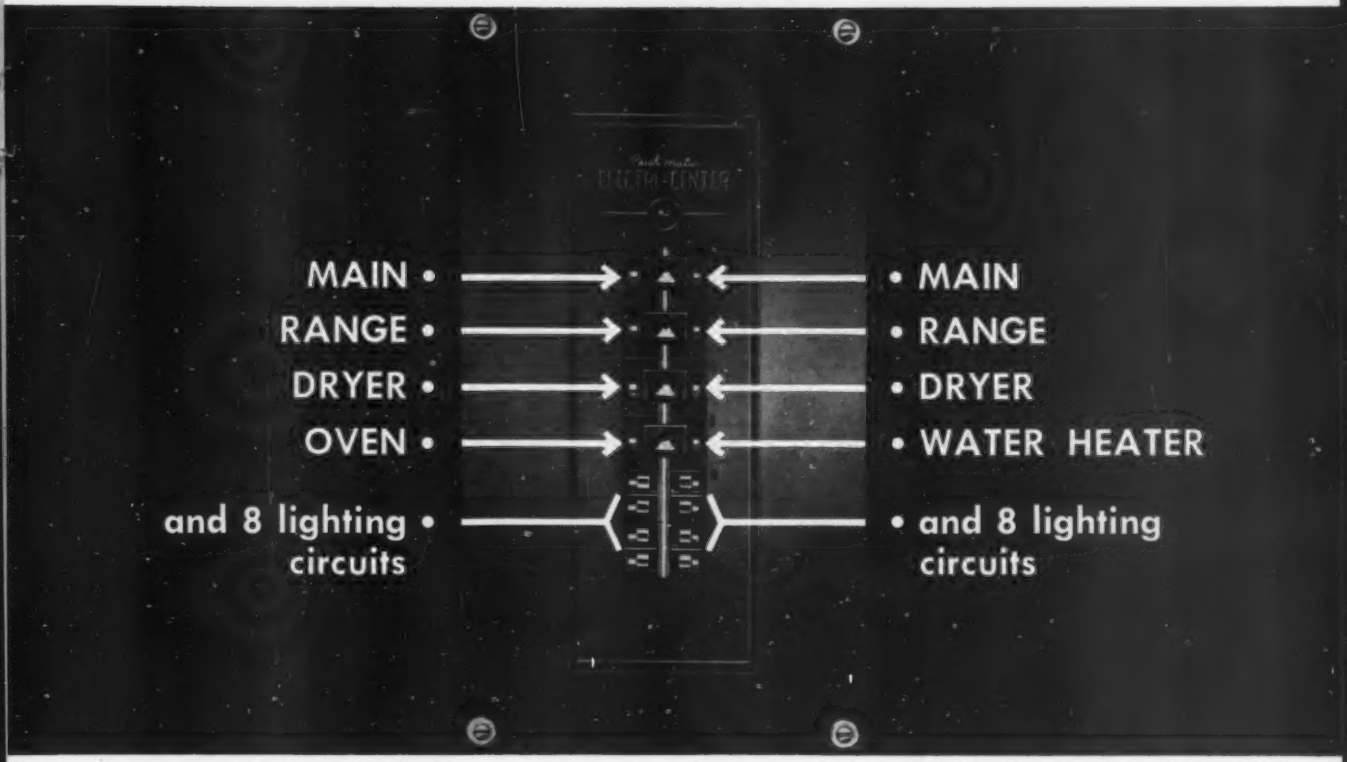
Write in No. D120 on card, pg. 17

CONNECTOR BULLETINS — Six new bulletins have been released by Ilsco Corp., 4730 Madison Rd., Cincinnati, Ohio. They cover the Ilsco line of solderless connectors, special connectors, lugs, neutral bars, crimp lugs, and the Ilsco Lok-A-Blok. The bulletins include descriptive material, dimensions, and packaging data.

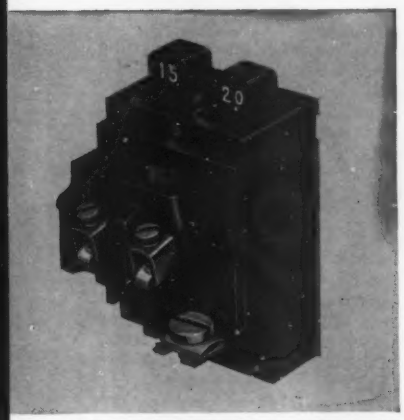
Write in No. D123 on card, pg. 17

TROFFER CATALOG—A 36-page catalog, with complete information on their newly re-designed architectural troffers has been released by Smithcraft Lighting Division, Chelsea, Mass. Divided into sections for selection of lighting units, the catalog gives complete illustrations and data for 1 and 2 foot troffers in all types of ceiling construction. Also included in the catalog is informa-

GET THIS . . . . . OR THIS



ONLY IN BULLDOG'S 12-CIRCUIT ELECTRI-CENTER®



New Duplex Pushmatic puts two circuits in the space of one single breaker. Gives: identical, independent coil-magnetic protection in each pole of all Duplex breakers; positive one-bolt connection; pushbutton convenience.

Only BullDog Pushmatic circuit breakers give you both of the above combinations—plus many others—in a 12-circuit panel. Other breakers would need a 16-circuit panel.

The BullDog Pushmatic® 100-amp breaker takes only two spaces, compared to the four spaces needed for any competitive 100-amp breaker. And new BullDog Duplex Pushmatic puts two lighting circuits in a single space. Count 'em . . . all the circuits shown in only 12 spaces!

You save space by using smaller panels. You provide the maximum in electrical circuit flexibility and protection. Pushmatic protects two ways—coil short-circuit and thermal overload protection. To put more electrical services into less space, see your BullDog products representative.

Pushmatic 100-amp breakers take only two spaces compared with four spaces required for all competitive 100-amp breakers. Pushmatic 100-amp breakers are now available for field installation.

BullDog Electric Products Division, I-T-E Circuit Breaker Company, Box 177, Detroit 32, Michigan. In Canada: 80 Clayson Rd., Toronto, Ont. Export Division: 13 East 40th St., New York 16, N. Y.

BULLDOG ELECTRIC PRODUCTS DIVISION
I-T-E CIRCUIT BREAKER COMPANY

Consult the following Southern representatives:

Wilson Electrical Equipment Co.
3210 Garrow St., P.O. Box 1725
Houston, Texas

Wilson Electrical Equipment Co.
101 E. Maple Street
San Antonio, Texas

Standard Electric Mfg. Company
2401 Federal St., P.O. Box 1138
Dallas 1, Texas

Walker Electrical Co., Inc.
125 Bennett St., N.W., P.O. Box 2308, Station D
Atlanta, Georgia

CATALOGS and BULLETINS

Available Free to Readers of Electrical South upon Request

tion on ceiling lighting patterns, shielding designs, lighting techniques and applications.

Write in No. D126 on card, pg. 17

LIGHTING FIXTURES—Progress Manufacturing Co., Castor Avenue and Tulip Street, Philadelphia 34, Pa., announces the publication of two new lighting catalogs. "Lighting by Progress," a 52-page booklet, describes their line of residential fixtures. "Home Lighting by Minute Mount" is a 12-page bulletin illustrating new ideas in budget lighting.

Write in No. D131 on card, pg. 17

MOTOR CONTRACTORS — For control of large motors, primary switching of induction furnace transformers, and other high voltage applications, **Allis Chalmers Manufacturing Co.**, Milwaukee 1, Wis., has developed the **high voltage air-break contractors** (type 256A) which are described in a bulletin issued by the company.

Write in No. D132 on card, pg. 17

ELECTRICAL DUCTS — A brochure is now available from Johns Manville, 22 East 40th St., New York 16, N. Y., describing their line of Transite electrical ducts. The two-color, 11-page, illustrated bulletin contains information on composition, methods of manufacture, applications, costs, and installation. Also included are shipping weights and dimensions of Transite conduit and Korduct.

Write in No. D133 on card, pg. 17

TRANSFORMERS—R T & E Corp., 1900 E. North St., Waukesha, Wis., has available a bulletin describing Terra-Tran transformers for residential underground distribution. The 15-page booklet is illustrated and contains complete information on construction, application, and design features.

Write in No. D135 on card, pg. 17

RADIANT HEATING — Ceilheat, Inc., 5212 Homberg Dr., Knoxville, Tenn., has announced the availability of a bulletin describing their line of concealed radiant home heating systems. The bulletin includes the principles of radiant heating, installation procedures, and advantages of this heating system.

Write in No. D138 on card, pg. 17

EXPLOSION-PROOF EQUIPMENT —"An Electrical Engineer Comes to Crouse-Hinds" is the title of a new 6-page folder by Crouse-Hinds Co., Syracuse 1, N. Y. The bulletin describes design and construction principles involved in manufacturing Crouse-Hinds Condulet electrical equipment for hazardous locations.

Write in No. D140 on card, pg. 17

RESIDENTIAL LIGHTING — A new catalog featuring their line of residential lighting fixtures has recently been issued by John C. Virden Co., 6103 Longfellow Ave., Cleveland 3, Ohio. The 48-page booklet is illustrated and in color. It pictures and describes incandescent and fluorescent fixtures for every room in the house and every design motif.

Write in No. D141 on card, pg. 17

HYDRAULIC EQUIPMENT—Truck Equipment Co., 3963 Walnut St., Denver 5, Colo., has made available a catalog containing information on their lines of hydraulic derricks, cable reel carriers, and diggers. It is illustrated and contains data on design features, specifications, and application.

Write in No. D142 on card, pg. 17

WATER HEATING BOILER — Precision Parts Corp., 400 N. First St., Nashville 7, Tenn., has available a bulletin containing catalog information on their electric hot water heating boiler, diagrams of the boiler, and data on the advantages of its use. The boiler comes complete with water circulator and safety valve on models A through K.

Write in No. D143 on card, pg. 17

FLOOD LIGHTING STANDARDS — An 11-page booklet describing their line of flood lighting standards is available from Kerrigan Iron Works, Inc., P. O. Box 479, Nashville 2, Tenn. Contained in the booklet are catalog data, diagrams of the equipment, specifications, and suggested methods of wiring supply to floodlights, as well as other installation procedures.

Write in No. D144 on card, pg. 17

CONNECTOR TOOLS—The Thomas & Betts Co., Inc., 72 Butler Street, Elizabeth 1, N. J., makes available catalog D59 including new compression connectors and installing tools recently developed. The tools are for use at usual distribution voltages and for "hot line" applications. New heavy duty tap connectors, double taps, stirrups and single sleeve ACSR tension splicers have many exclusive features and are designed to give high performance and easy installation.

Write in No. D145 on card, pg. 17

WIRING EQUIPMENT — An abridged catalog of industrial, commercial, and residential wiring items, gives all specifications for such wiring needs as switches, adapters, receptacles, and cord sets made by the Leviton Manufacturing Co., Inc., Brooklyn 22, N. Y. Designed for distributors and contractors, the catalog includes catalog numbers, prices, packing, weights, descriptions and indexes.

Write in No. D146 on card, pg. 17

ELECTRIC HEATERS—The new catalog of electric space heating equipment available from Meier Electric, 3525 E. Washington St., Indianapolis 7, Ind., includes complete details on the Meier Tandem Plug-In baseboard heaters, wall insert heaters, radiant heat cable, and portable units. Included in the brochure is the Meier's Heat Determinator, a simplified guide to electric space heating application.

Write in No. D148 on card, pg. 17

ELECTRICAL ENCLOSURES — Catalog Number 6061 currently being offered to the trade by B & C Metal Stamping Co., 590 Means St., N. W., Atlanta 18, Georgia, is a well organized compact 132 page manual. The Catalog is divided into two distinct sections, one covering products for the Utilities, and the other section covering products for the Electrical Contractor. This Catalog offers complete descriptive information, prices, and specifications on all items in the B & C line of Electrical Products and Devices. Copies are available free of charge to Distributors, Contractors, Architects and Engineers, and Utilities.

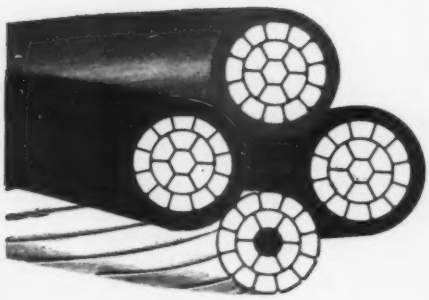
Write in No. D149 on card, pg. 17

ELECTRIC HEATING—A 34-page descriptive packet containing color illustrations and complete specifications of eight major types of electric heating units and controls is now available from Arvin Industries, Inc., Electric Heat Div., 13th and Big Four Road, Columbus, Inc. Both radiant and fan-forced heaters are included, in wall, baseboard, and ceiling models.

Write in No. D150 on card, pg. 17

COLOR EVOLUTION

Triplex Secondaries by **SOUTHERN ELECTRICAL** Take on Lasting Color With **HYPALON®***



COLOR-CODED CABLES Insulated With HYPALON® Have These Major Advantages:

- Positive phase identification, permitting load balancing;
- Available in black, electrical red and electrical grey;
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- Excellent resistance to heat, chemicals, flame;
- Improved resistance to compression cutting when used on COMPRESTO®;
- HYPALON® can be stripped freely at field temperatures;
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*Synthetic rubber covering with properties that exceed Two-Coat coverings for service drop cables.

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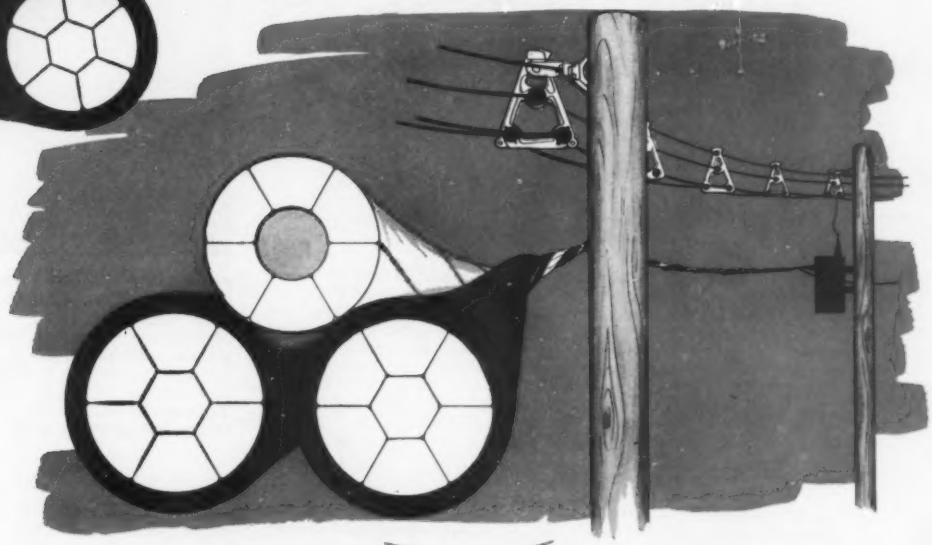

Southern Electrical Company

OLIN MATHIESON • METALS DIVISION • CHATTANOOGA, TENNESSEE

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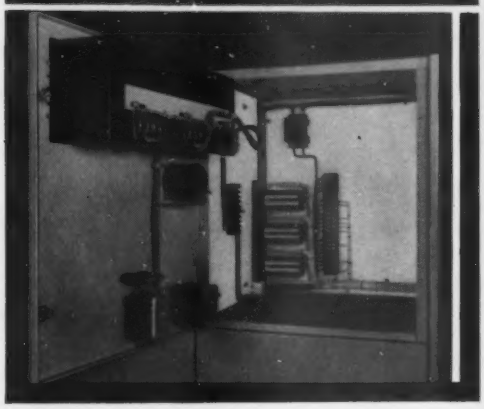
NEW COMPACTNESS

NEW SAFETY

NEW EASE OF ACCESS

NEW STORED ENERGY

This is the all-new I-T-E type HK metal-clad switchgear



Roomy interior for easy access. Only I-T-E gives you a separate 30-in.-high instrument compartment, completely isolated from the high-voltage compartment. And it's closer to the floor, so you can reach into it easily. Put your elbows in and work in comfort. High visibility white interiors simplify installation and trouble shooting. Your control wiring can easily enter from the bottom or through the top sheet.

Free detailed bulletin—new strip film. Get the whole story about *all* the new advances in this I-T-E metal-clad switchgear. Learn about its easier operation, greater safety, and superior protection. Send for Bulletin 2801-2A. And ask also to see the new sound strip film. Can be shown to you singly or to your group. Contact your nearby I-T-E sales office or write I-T-E Circuit Breaker Company, Dept. SW, 1900 Hamilton St., Philadelphia 30, Pa.

Fits where others won't. This is a 4160 volt switchboard. See how low and shallow it is compared with old standards. It's only 80 in. high and 58 in. deep. So it saves both floor space and overhead space. Goes easily under low ceilings. Fits in narrower aisles. And its reduced height puts all instruments at easy-to-read eye level. Roomy cable compartments at the rear are accessible through hinged doors. All insulation in the switchboard and circuit breakers is flame-retardant and track-resistant.

Closed-door drawout. The door stays closed while the breaker is moved from connected . . . through test position . . . to disconnected and back. There's always solid steel at ground potential between the operator and the live parts of the gear. Even an inexperienced man is completely safe. Since doors stay closed, aisles need never be cluttered. And foreign matter can't get into breaker compartments.

Stored energy closing. This is not simply a new feature added to an old design. It is integrated into a completely new circuit breaker design. Gives you fast, uniform closing every time. Prolongs contact life. And you can close the circuit breakers even without control power. For greater economy, the spring charging motor draws only one-tenth the current of previous methods.

Easy-to-change current transformers. They're accessible from the front. You don't need to disturb your cable connections at all. Just remove the shutter barrier assembly over the primary studs, and there they are. As this view shows, you can locate current transformers on both load and line sides of the circuit breaker, providing more flexibility in relaying.

Compact 4160 volt circuit breaker. Low center of gravity permits easy, safe, one-man maintenance. High-strength, flame-retardant track-resistant moldings eliminate need for structural metal above the base frame. Provides insulation strength where needed most. Arc chutes tilt for easy inspection. Lift off without tools. Modern materials and new design result in substantial reduction in circuit breaker size.

I-T-E CIRCUIT BREAKER COMPANY

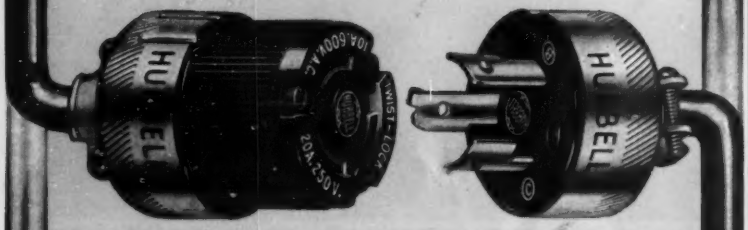
ONLY

HUBBELL

MAKES *SUPER*

Twist-Lock®

WIRING DEVICES



CAT. NO. **3323**
SUPER TWIST-LOCK
ARMORED BODY
20 AMPERES, 250 VOLTS, AC OR DC
10 AMPERES, 600 VOLTS, AC ONLY

CAT. NO. **3321**
SUPER TWIST-LOCK
ARMORED CAP
20 AMPERES, 250 VOLTS, AC OR DC
10 AMPERES, 600 VOLTS, AC ONLY

Super Twist-Lock devices are smaller, more compact and lighter in weight than regular Twist-Lock units. On the surface they look very much like their conventional brothers but actually they incorporate important construction features that place them in a class by themselves. Both the cap and connector body feature screwless pressure grip terminals which simplify and speed wiring and a revolutionary 2-piece dead front construction that seals out dust, dirt, lint, metal chips, etc. Terminals are pressure locked between the two independent sections so that all wiring is completely enclosed . . . the ultimate in wiring safety and security.

All units in the Super Twist-Lock line can be interchanged with regular Twist-Lock connectors of equal rating. This is most advantageous in industrial plants where regular Twist-Lock devices are now installed on machine tools or other equipment.

For complete information on Hubbell Twist-Lock devices, see Hubbell Catalog #29 or check Sweet's File 3lb/Hu.

IT PAYS TO HAVE GOOD CONNECTIONS — HUBBELL

HARVEY

HUBBELL

INCORPORATED

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In Canada: Scarborough, Ontario

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ATLANTA 8, GEORGIA

Red Throat
BM-21B
½" Connector
BM-22B
¾" Connector
BM-23B
1" Connector

BM-41
½" Coupling
BM-42
¾" Coupling
BM-43
1" Coupling

BM-51
½" Offset Connector
BM-52
¾" Offset Connector

BM Offset Connectors showing how wires are guided over box edge.

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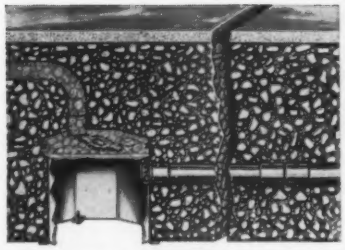
Save time and money with

B-M ORIGINAL INDENTER FITTINGS

Here is the combination that is unbeatable when it comes to easier E.M.T. installation at less cost. New lightweight plier size indenters make setting up thin wall conduit a breeze. B-M fittings are neater too! No unsightly nuts or projecting set screws.

A few more of the plus features of B-M fittings are Concrete tight—Vibration resistant—Extra heavy bright zinc plate, salt spray and acid drip tested for corrosion resistance—Extra heavy positive bonding locknuts—smooth rounded edges or bushed throat type connectors that prevent insulation damage—All steel construction with extra heavy gauge wall thickness.



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When setting E.M.T. in concrete you can make each job easier and more profitable by using Briegel All Steel Indenter Fittings that have UL approval as Concrete-Tight. Contractors everywhere recognize their cost cutting qualities and the fact that they make each wiring job a better job. It is only natural that Briegel Fittings are the most widely used E.M.T. connectors and couplings.

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GALVA • ILLINOIS

USED THE MOST FROM COAST TO COAST

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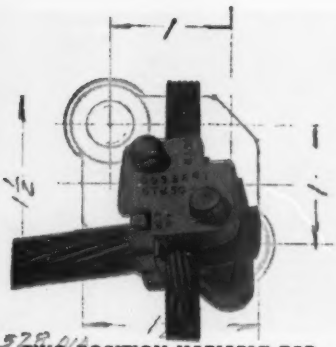
with YOU in mind!



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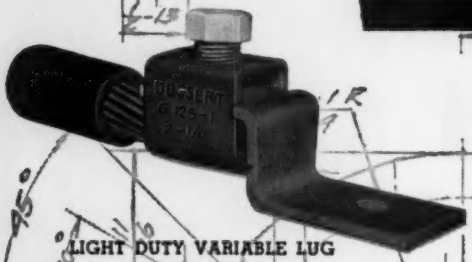
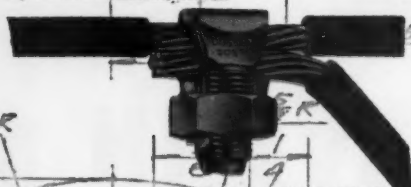
(Type GTX)
For cross, parallel and tee tap connections.



LIGHT DUTY VARIABLE LUG
(Type G)
For economical, all-purpose cable connections.



SPLIT BOLT CONNECTOR
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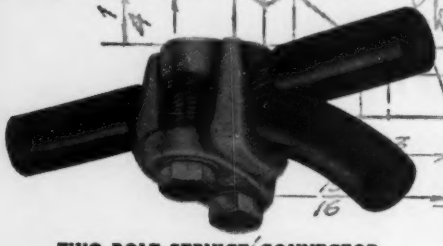
For taps, dead-ends, entrances, motor leads, junction boxes, etc.

VARIABLE TERMINAL
(Type D)
Connects a wide range of copper conductors to flat bar.



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For all service cable connections. Best for larger sizes.

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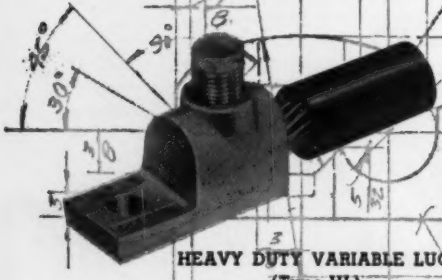
For YOU, the wholesaler...

The products shown here are in constant demand by contractors and are fast moving stock items. All items accept a wide range of cables, thereby, minimizing the number of stock sizes. They are packaged in convenient quantities for ease of handling and are attractively labeled for quick identification.



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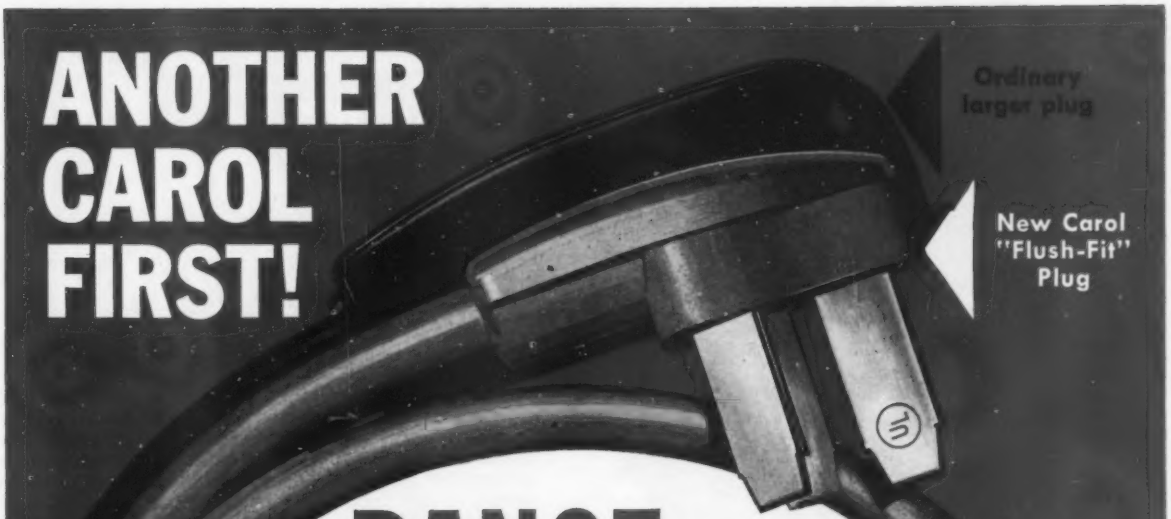

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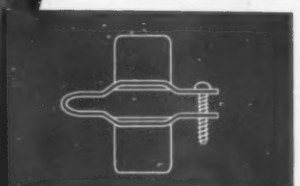
Featuring "Flush-Fit" Molded-on Plug



NEW COMPACT DESIGN! Special Carol molded-on plug only one-half the size and weight of ordinary types . . . fits flush against receptacle.

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THE ALLEN-BRADLEY LINE of BULLETIN 700 RELAYS IS COMPLETE!

TYPE B general purpose relay shown with 2 N.O. and 2 N.C. contacts. Made with up to 8 poles in various contact arrangements.

TYPE BX universal relay shown with 4 poles having both N.O. and N.C. contacts. Additional contacts on the 6 and 8 pole relays are N.O. only.

THESE IMPROVEMENTS ARE *IMPORTANT!*

These improved Bulletin 700 Type B and Type BX relays are establishing new standards for relay life and reliability. New design increases mechanical life by *at least 5 times*... a new contact motion insures *at least 10 times* greater electrical reliability. Double break, silver contacts never need maintenance, and the new molded coil is impervious to the most severe atmospheric conditions.

These new A-B relays—with their *extra millions of trouble free operations at no increase in price*—are a bargain in the relay field. Write for complete details, today.

A-B QUALITY

NEW ENCLOSURES

for the Bulletin 700 relays are styled by Brooks Stevens—internationally famous industrial designer. Note the "family" resemblance of these enclosures.

NEMA 1

NEMA Type 1 for general purpose applications with wrap-around cover for ready accessibility. It has a "quality" appearance.

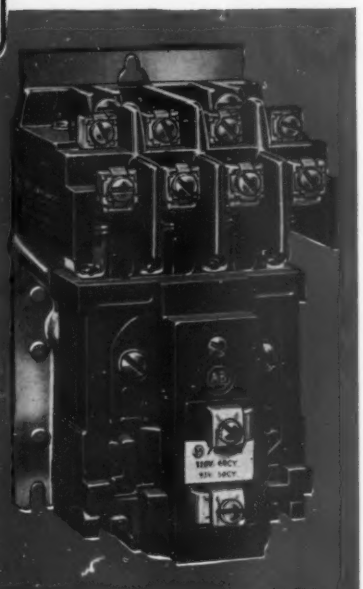
NEMA 4

NEMA Type 4 enclosure for applications that require a watertight and weather-proof seal.

NEMA 7

NEMA Type 7 enclosure for NEC Class 1, Group D hazardous gas locations.

TYPE BR Bulletin 700 convertible contact relay shown with four poles. Made with up to six poles in line.



No other relay offers such simplicity in changing contacts from N.O. to N.C. (or vice versa)—it takes only 60 seconds!

A four pole unit provides any of the contact combinations otherwise available only with five relays of the fixed contact type. You can reduce your relay inventories. In tests, this relay has *proved* it will provide many millions of trouble free operations. Double break, silver contacts never need servicing. Also, each relay can have one or two complete and full rated contacts added to its base—in the field—without increasing space requirements. If you don't know about the Type BR relay, let's get acquainted.

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continuous loadability

General Electric's new Permalex* insulation system increases medium transformer continuous kva capability, or gives five times longer transformer life

Now, as standard on all medium transformers**, and at *no extra price*, General Electric uses Permalex insulation . . . a system permitting transformers designed for 55 C rise to operate at 65 C rise with 12% more continuous capacity!

For example, a 3750-kva, 55 C transformer with Permalex will operate at **4200 kva**, 65 C rise with normal life expectancy. Or, if you prefer to operate the unit at 55 C, you can expect five times the life of present insulating systems! Fan-cooled rating increments remain the same and can be applied at the 65 C operating condition. Also, Permalex is *completely compatible* with everything in the transformer.

The Permalex system used in General Electric medium transformers features Formex† wire and cyanoethylated paper insulation. Formex insulated wire offers exceptional dielectric strength, outstanding thermal stability and high resistance to moisture effects. Cyanoethylation, which replaces many moisture producing molecules with non-moisture producing molecules, raises the thermal endurance of paper and retards the formation of water.

Ask your G-E Apparatus Sales Engineer to point out the many ways you save with Permalex insulated transformers . . . another result of General Electric's *continuing* Certified Full-value Transformer Program. General Electric Company, Schenectady 5, New York. 416-29

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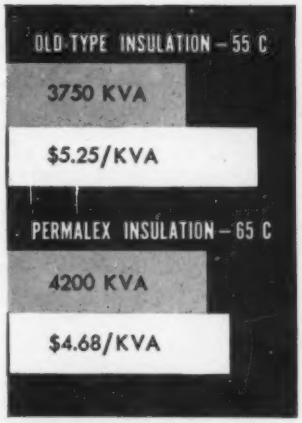

PERMALEX INSULATION gives you extra kva at no additional transformer cost. The result is more economically uprated substations because of the lower cost per kva with no increase in transformer size.

55 C Self-Cooled	65 C Self-Cooled	65 C Fan-Cooled
750 kva	840 kva	966 kva
1000	1120	1288
1500	1680	1932
2000	2240	2576
2500	2800	3500
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FORMEX TURN INSULATION with cyanoethylated paper insulation provides high dielectric strength, outstanding resistance to moisture and much longer life for medium transformers.

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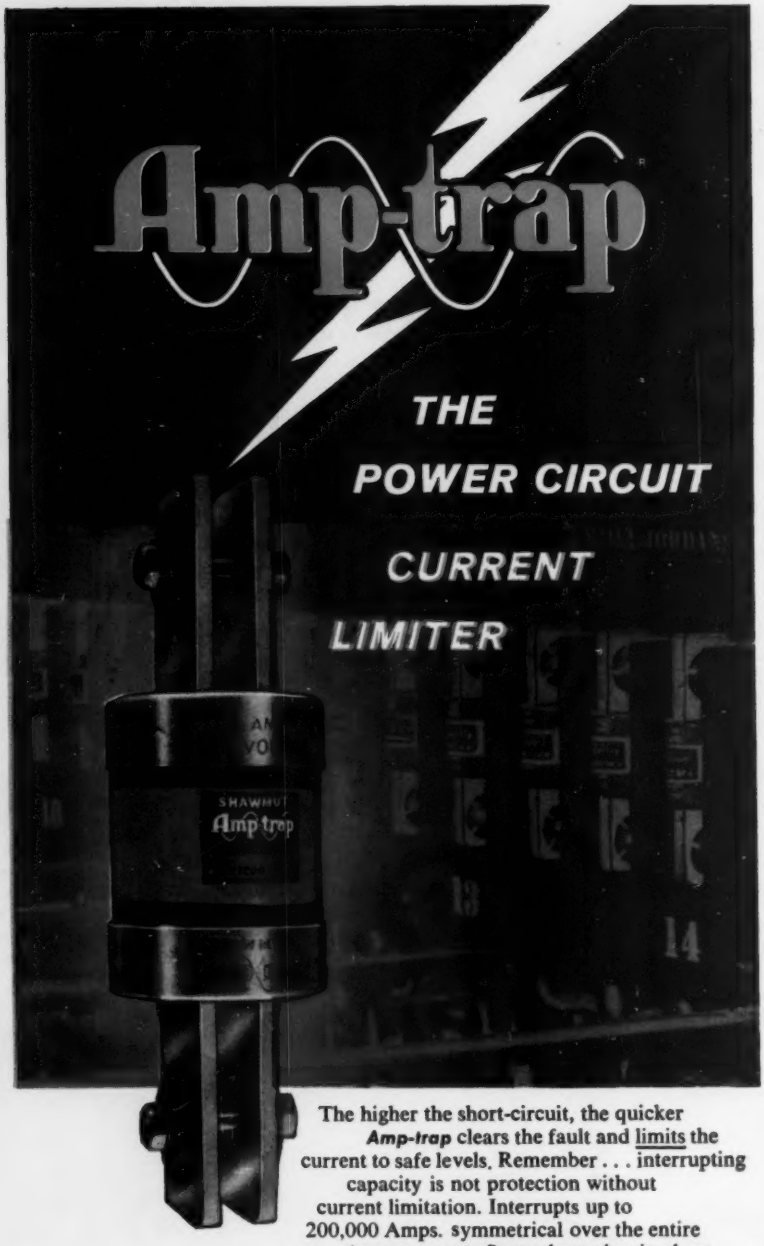

The higher the short-circuit, the quicker ***Amp-trap*** clears the fault and limits the current to safe levels. Remember . . . interrupting capacity is not protection without current limitation. Interrupts up to 200,000 Amps. symmetrical over the entire Ampere range. Stops short circuits short. Anticipates and prevents destruction before it can occur. Faster than any ordinary fuse.

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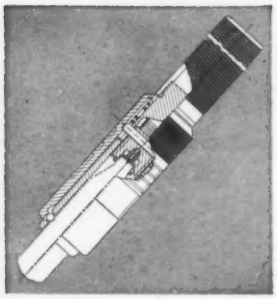

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This entirely *new*, improved Jet Line Gun costs only *one third as much* as the former model! No contractor can afford to be without it!

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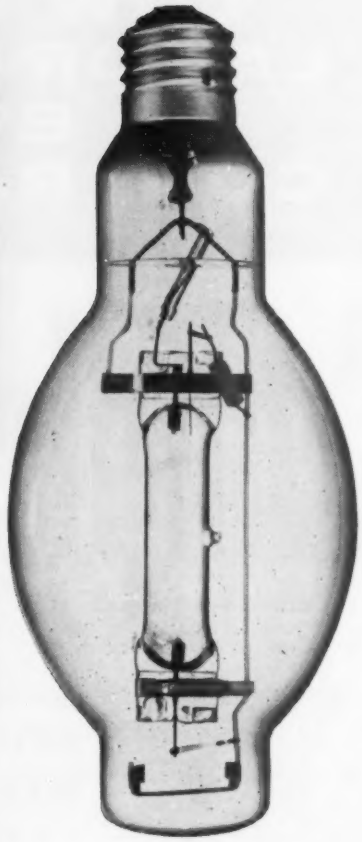
6000 USEFUL HOURS EXTRA



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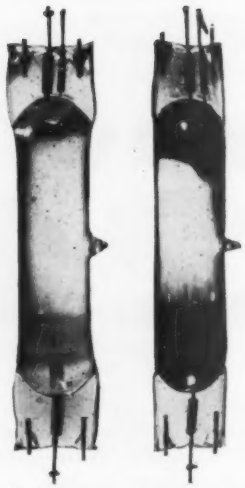
Men in the know . . . know they get important differences when they specify General Electric Lamps—whether they're mercury, filament or fluorescent. So let your General Electric Lamp distributor explain the important plus you can get in the lamp types you use. General Electric Company, Large Lamp Department, C-033, Nela Park, Cleveland 12, Ohio.



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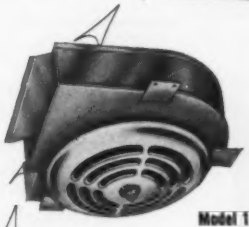
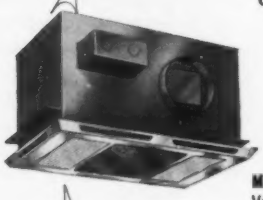
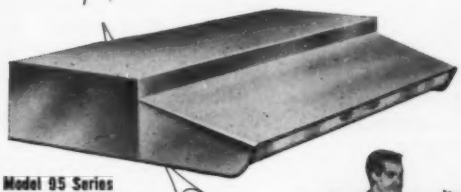


Model 1020-A
Ceil-N-Wall Ventilator



Model 657-C
Ventilator-Light-Heater



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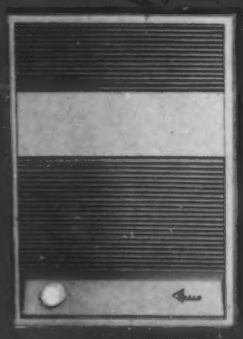

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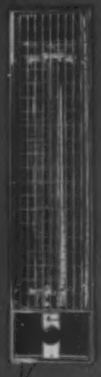

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Pre-determined "balance" between Fasco's electric heating and ventilation units bring uniform comfort and highly efficient control of both air freshness and warmth. Although units are self-sufficient and independent in their operation, they are also designed to work efficiently as a balanced combination in home heating and ventilation.

In complementing each other in performance and progressive "Slim-Trim" styling, these units offer highly-saleable features to builders and contractors. In addition, Fasco's researched ventilation and heating lines are remarkably trouble-free and easy to install.

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Time-savers

By B. S. Miller

This article should be especially helpful to the following readers:

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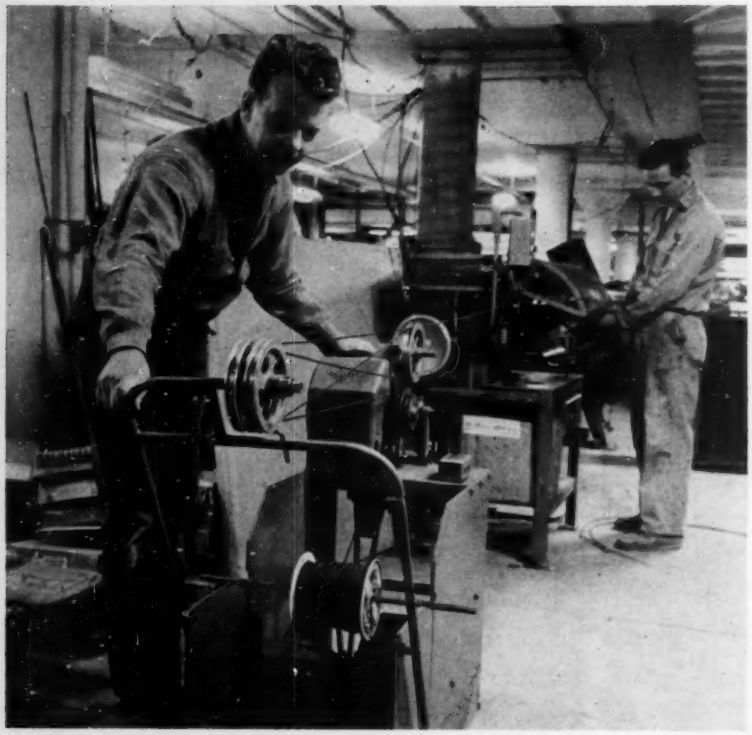
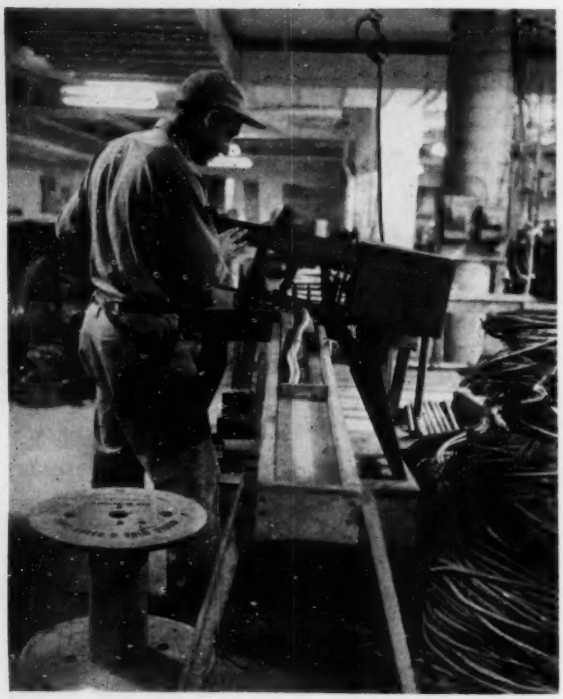
- Electric Utilities
- Electrical Wholesalers
- Electrical Inspectors
- Industrial Engineers
- Consulting Engineers



This wirestripper and cutter is an example of the time saving devices used in the recent light and power installation of a State Department building in Washington, D. C. This machine, which is fully automatic, operates unattended after the gages are set for certain lengths.

◆ MANY TIME-SAVING procedures were used in the enormous light and power installation (transformer capacity totals 32,000 kva) of the new 8-story State Department Building extension and remodeling, according to Francis McMahon, field superintendent for the project handled jointly by Harry Alexander, Inc., and E. C. Ernst, Inc., of Washington, D. C.

Substantial man-hour savings resulted from the use of power



A bandsaw is used to cut greenfield in the shop to proper lengths. All possible work of this type was performed before delivery to the area needed.

This electric hoist was used to lift and relocate switchgear. All materials were distributed as received to eliminate more than one handling.

speed work on mammoth building

tools and equipment in this four city-block building, with usable floor space in excess of 1,500,000 square feet.

Having one of the largest underfloor duct installations of any building of comparable size, this project scheduled materials flow with a 24-hour notification of shipment from the manufacturer. Subsequent notices en route kept the electric companies posted to within two hours of arrival in order to prepare for its reception at the site, according to Mr. McMahon.

Notified 24 hours ahead

"We were not only notified 24 hours in advance of shipment of all equipment, but knew at what time the materials were actually leaving the factory and when they arrived two hours out of town, so that we had two hours of preparation to assign men at a given point at a given time and to have the crane in readiness.

"Conduit and underfloor duct were baled in a manner so that chokes could be slipped around materials without having to move or lift anything. All materials were immediately placed on the various floors on which they were to be used to eliminate more than one handling," stated Mr. McMahon.

In a shop set up on the location, time saving machines were employed and all materials prefabricated before being sent to their exact place. A bandsaw cut 70 pieces of conduit simultaneously instead of single lengths. All cutting on an individual job was avoided. All bolts and hangers were computed to proper length from the drawings instead of cutting on the site. Leveling was done with a transit instead of hand levels.

A wire stripping and skinning machine saved incalculable manhours by permitting the setting of lengths on gages and the preparation of 5000 feet of reel wire. Setting ⅞-inch wire at one end and ½-inch on the other, the machine handled the entire stripping and cutting operation without attendance.

A Jetline gun proved a great time-saving device for "shooting a line through conduit in lieu of fishtapes," Mr. McMahon pointed out.

A motorized chain hoist was another invaluable time-saver used in lifting equipment weighing over ½-ton. Switchboards, for example, were raised into position by the electric chain hoist.

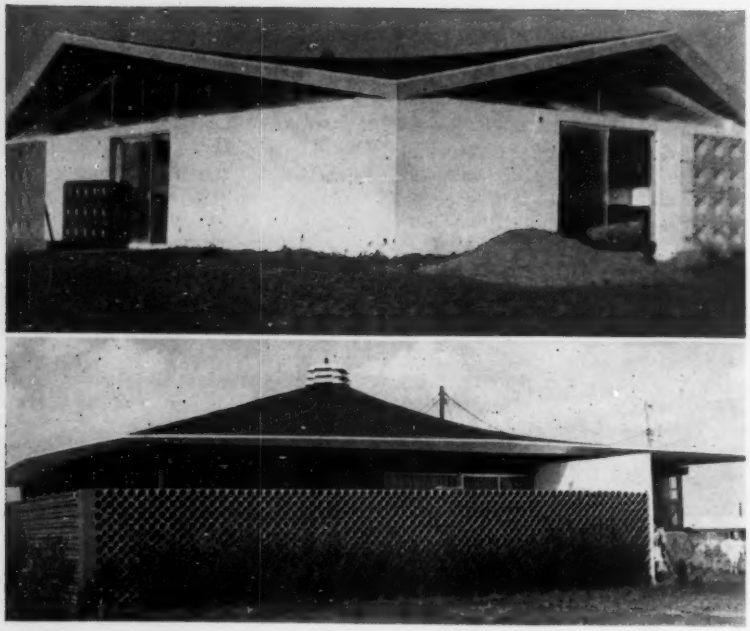
Cable was reeled by the factory in parallel lengths of four so that handling time was greatly reduced. Four-wire circuits could be

(Continued on page 138)

By its nature, the International Conference Room's luminous ceiling defied time-saving devices.

The bandsaw above was used for cutting 70 pieces of EMT at one time in the shop set up for Harry Alexander, Inc., and E. C. Ernst, Inc., jointly employed for the electrical construction job.

Problems in wiring an all-concrete



Two kinds of roofs were used in this project—the hyperbolic paraboloid with support at four corners and the umbrella type with a single center support as shown in the interior view below.

By W. U. McCoy

This article should be especially helpful to the following readers:

- Electrical Contractors ✓
- Electrical Utilities ✓
- Electrical Wholesalers ✓
- Electrical Inspectors ✓
- Industrial Engineers
- Consulting Engineers ✓

◆ AN ENTIRELY NEW approach to the all-concrete home is finding strong acceptance among home buyers in Oklahoma City, and is challenging electrical engineers with some new problems. The first six built during the fall sold much more readily than builder Harold Hessel's conventional houses, and plans for a development of 50 are on the drawing boards.

Initial cost compares favorably with conventional construction. Insurance is the minimum—quoted at 85 cents a month. FHA has given its maximum permanent dwelling life-rating. Heating and cooling promises to be low, and maintenance is negligible since there is nothing in the basic structure to rack, warp, rot, or deteriorate.

Architect R. Duane Conner's fresh thinking promises to have an impact on the home building industry. At the same time, the electrical contractor, N. J. Atherton, points out that the homes require just as different an approach to estimating and to wiring and fixture installation.

Roof is key

The hyperbolic paraboloid concrete shell roof is the focal point of the structure. The architect suggests visualizing the shape as a warped quadrangle. If one corner of the flat quadrangle is raised, the structure is then curved, with parabolic arches going in one direction, hyperbolic curves in the other. Forces in each direction are balanced so the roof cannot bend. Only a minimum of concrete and steel are necessary; masses of materials are not needed for strength.

The roof is the key to the ad-

house

vantages of such a home, and it also forces special wiring considerations. Since the 3-inch steel reinforced concrete shell is both roof (with the application of either built-up roofing or plastic resin coating) and ceiling (with use of either permanent formboard or sprayed asbestos) no conventional overhead wiring is possible.

Since no supporting walls are used, either exterior or interior, there is no conventional rough-in. Contractor Atherton says this makes wiring harder to visualize.

Nationally-known architect Conner had already used this type of roof in large buildings such as churches and university fieldhouses, and he is believed to be the first to adapt this idea to home building.

Two general types of the houses have been built: One in which the 72,000 pound shell rests on center support only; the other in which the shell rests on four corner piers. Either type permits wide freedom of interior arrangement and use of glass from top of walls to roof.

Roughing-in schedule

It is necessary for the electrical contractor to tailor his schedule to that of the building crew and work with them as the job shapes up.

After foundations are dug and steel reinforced concrete supporting piers are formed, light wall piers are formed, then double concrete walls are poured in place. Walls are 7½-inch, with forms holding reinforcing rods and insulating board in center; the rigid conduit is fitted in, with wire pulled in after concrete pouring.

A 90-degree ell is used to hook back under the slab floor, with threadless rigid connection to couple in feeder under the slab. Mr. Atherton first used a shorter ell, then went to next size to make it easier to pull wire. And although the 2⅛-inch box is code standard for concrete work, it was necessary to use boxes of 2½-inches for this installation to give adequate room.

Under-floor conduit is then run and wired in and slab is poured.

Service masthead goes through concrete roof where 4-foot overhang is used. Note the all-glass area between walls and roof. This glass extends all around the house, with no supporting walls used.

Electrical contractor, N. J. Atherton shows panel in utility closet just off kitchen in the house. Feeders from bottom go under slab and into concrete walls; feeders from top go to overhead construction.

Some of the interior partition walls are of standard studding and sheetrock construction, and it was not necessary to use rigid conduit here. Since some of these walls are only 4 inches thick, however, back to back boxes had to be only 1½-inches deep instead of the standard 2⅛-inch. Architect Conner and builder Hessel are going to use foam concrete for all walls in future construction, requiring more use of cast-in rigid conduit.

Special fixtures

Mr. Atherton used bracket-type bullet lamps in kitchen and bedroom areas. The lamp in the kitchen carries a flood that illuminates the kitchen, dining room and part of the living room. Lamps in bedrooms may be used as floodlights, or turned up for use as indirect lighting. Seven outlets are provided in the living room. Doorbell wire is fed across the top of the inside wall.

By utilizing space at top of closets, concealed fluorescent lighting has been used in some of the houses. One eight-foot fixture with two 40-watt lamps and one four-foot fixture with two 40-watt lamps illuminate three bedrooms and a hallway.

Another variation is a false beam in the kitchen that has been used in some of the houses to carry wiring. Service masthead of 1½-inch rigid conduit comes down through concrete shell to the panel in the utility closet just off the kitchen. From the panel, three of the eight circuits lead out of the top to conventional construction; other wiring leads out from the bottom to rigid conduits in walls and under slab. One ¾-inch rigid conduit feeds the built-in oven and the surface unit of the stove.

Full attention has been given to adequate wiring and outlets in these houses, because of the difficulties of changes. Weatherproof receptacles have been provided on the outside of the house; one at the back, near kitchen door, and one at the patio area, both near base of wall.

Mr. Atherton said wiring on the first of these houses took twice as long as a conventional job, although he was able to cut the time later.

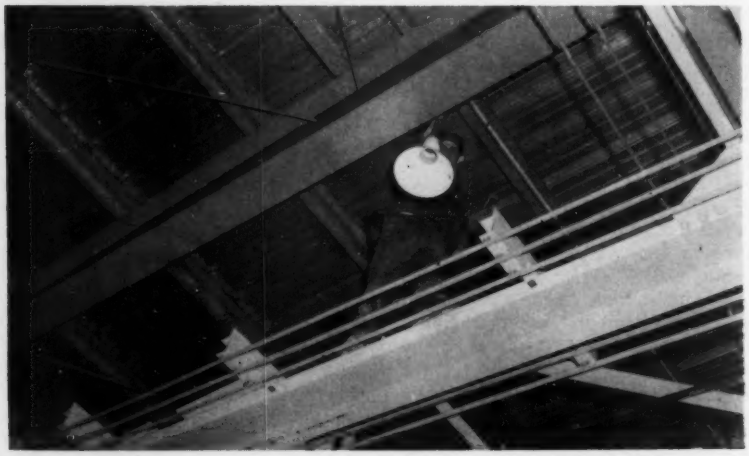
Cost increase

He says cost of wiring runs about one-third more because of the heavy use of rigid conduits and because the bracket-type lamps used are more expensive than the usual ceiling-type drop in conventional homes.

(Continued on page 137)

Bill McDaniels and David Smith pull wire for a lighting panel in a large prefab. Conduit will remain in view in this type of building.

Assembly of lighting units and other such jobs goes faster in a prefab building, in any weather, and without interruption by other work.



Mr. McDaniels installs a high-bay unit in a road equipment firm's shop. Bus bars at upper right power the large traveling crane.

Foreman Smith completes installation of conduit for main breaker.

Wiring

By Earl Turner, Jr.
Turner Electric Company
Knoxville, Tenn.

This article should be especially helpful to the following readers:

- Electrical Contractors ✓
- Electric Utilities ✓
- Electrical Wholesalers ✓
- Electrical Inspectors ✓
- Industrial Engineers ✓
- Consulting Engineers ✓

◆ PREFABRICATED metal buildings, once built only as rough warehouses, are now offering quite a construction market for electrical contractors. Office buildings, stores, and industrial plants are now being built from modern prefabs, which our company can wire much faster than conventional buildings.

We recently completed wiring

Shown above is the connection of a control unit for an overhead crane in the large shop of a prefab.

Checking an exhaust fan in the prefab's shop area was part of the job made easier in the prefab.

prefabricated buildings

on such a building for an automobile dealer, including shop, display room, and offices. We completed another such job for a freight truck terminal, and have a contract for the wiring on a prefab textile plant. At present, we are finishing a wiring job on an office building and shop for a distributor of heavy road equipment.

The construction of these buildings is advantageous where space is needed without posts or columns in the center for support. The buildings can also be most attractive, since panels are now obtainable in colors. Because many of these panels can be used as they are received from the factory, without additional finishing, electrical problems are created. In areas where such factory-finished panels are used, conduit must be run exposed. In these cases, the runs must be very neat and square in order to blend in with the building.

Structural support problem

There is also a problem of wiring support. Often outlets are desired in places where there is no structural member. In this case, we recommend Unistrut or similar channel application for support of fixtures, outlets, etc. In office areas where suspended tile ceilings are used, the wiring is done in the conventional manner.

On the road equipment company's building, we did the electrical designing as well as the installation. This building includes overhead traveling cranes and precision welding equipment, with high-bay lighting from 750-watt reflector type lamps in the shop area.

The offices have fluorescent lighting with prismoid louvers, following a new concept in low brightness light sources. Air conditioning is also included, as well as a telephone system with a complete automatic switchboard similar to a central plant installation. In addition, a public address system to be used for the shop and outside sales division was installed.

New skills required

There is a growing trend toward this new kind of buildings, which requires from the electrical contractor a certain amount of skill and neatness to make the electrical work fit the buildings. Such buildings, we find, can be wired to make a neat and attractive appearance, although most of the construction members are visible.

When such a building is erected, it is ready to wire, instead of waiting for the walls to go up and the roof to go on. On a conventional building of the size of the prefabs we have been working on, installation would cover several months as construction progressed

(Continued on page 137)

Some 1,500 light fixtures are on display at all times in the new Carter Electric store, Corpus Christi, Texas.

Spacious fixture display brings

By Ruel McDaniel

This article should be especially helpful to the following readers:

- Electrical Contractors ✓
- Electric Utilities ✓
- Electrical Wholesalers ✓
- Electrical Inspectors
- Industrial Engineers
- Consulting Engineers

◆ FIXTURE VOLUME increased by more than 200 per cent six months after Carter Electric Co., Corpus Christi, Texas, moved into its new location, designed and built to focus more attention on lighting fixtures.

When B. A. Carter, company owner, opened a contracting business three blocks from the present new location, he felt that the sale of lighting fixtures belonged with the contracting business, so he bought a stock of fixtures. He found the fixture business good, as he consistently pushed it along with his contracting business. However, he felt that his contracting business justified more fixture sales than he was producing.

To remedy the situation, Mr. Carter designed display space for some 1,500 light fixtures in his new store, located at 1611 S. Staples St. Fixtures are now displayed in a live socket, which are connected by 137 circuits built into a two-foot space between the old ceiling and a new one, installed during remodelling of the building.

Contractor in ideal position

"Every electrical contract involves fixtures in one way or another," Mr. Carter points out, "and we feel that the electrical contractor is the logical one to supply them. But we were handicapped before, for lack of adequate facilities for showing a full assortment of fixtures."

Since moving into the new location, with its attractive fixture display, the company has developed fixture business from three major sources:

(1) The general public, and particularly women, are coming to the 2,300 square-foot display and sales area and are selecting their own fixtures for either replacement of old fixtures or for their new homes.

(2) Building contractors are using the display as an aid to their customers in making final selection of fixtures.

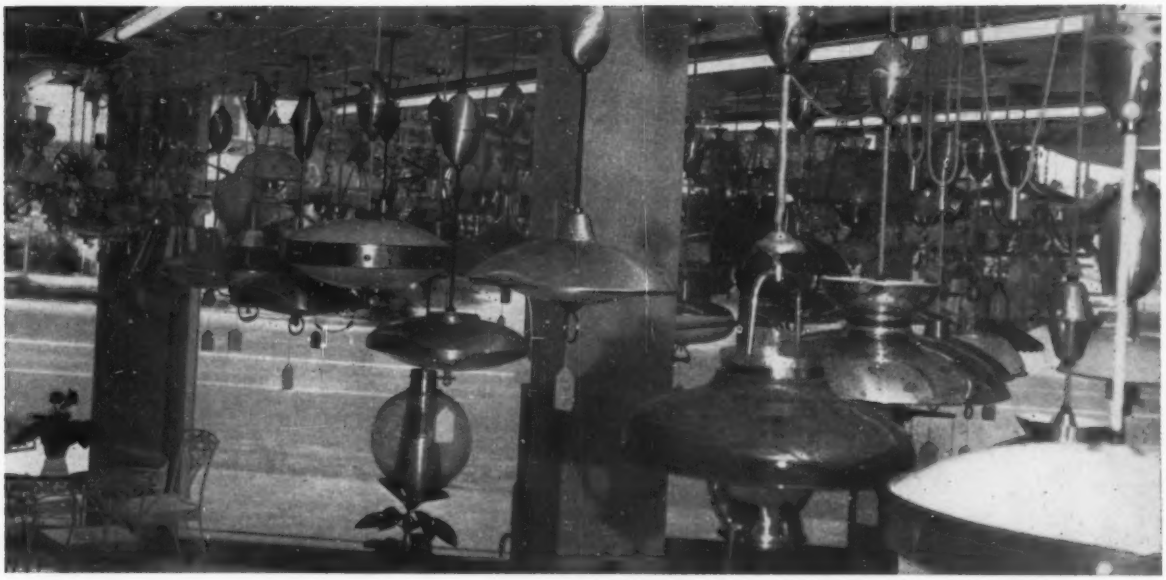
(3) Smaller electrical contractors now are relying on the Carter fixture stock for their own fixture needs, rather than trying to stock fixtures themselves.

A special display feature that is of particular value to contractors in the selection of lamps is a floor fixture built somewhat in the shape of a pup tent and painted an attractive contrasting color. This fixture displays over 200 different lamps on its two sides, representing a vast variety of sizes, colors and designs. Since lampsockets are "hot," every bulb on the fixture may be lighted at once if desired.

"Contractors use this display not only in making their own lamp selections," Mr. Carter explains, "but they bring in customers who want to make their own lamp selections, along with the personal selections of their fixtures."

Public demands display

Formerly, his fixture sales were confined almost entirely to building contractors, Mr. Carter says,



Fixtures are grouped together according to type in the overhead display area. All sockets are "live."

more sales

because the old store not only did not provide sufficient space for adequate fixture display, but was not particularly attractive to the public. Much of today's fixture business comes from individuals who buy new fixtures for old homes, Mr. Carter says.

Recently a woman who lived 160 miles from Corpus Christi came in, shopped the 1,500 fixtures on display and selected several for her ranch home, built many years ago. The total sale was slightly more than $400, cash.

"More and more we are becoming an area-wide fixture store," Mr. Carter declares, "as women come in from other communities, see the display and tell their friends. And of course some of our advertising reaches prospects in area communities, and that has helped to establish us as an area source of modern fixtures."

The larger home-building contractors appreciate the service provided by the display of fixtures, Mr. Carter has found, because it enables them to bring in the buyers of new homes and let them make their own fixture selections before installation.

"The average contractor has figured a specific sum for lighting fixtures in the total cost of the home," Mr. Carter explains. "He brings in his customer, tells her the amount the contract price of the home allows for fixtures. Then she casually makes her selections, staying within the fixture figure if she wishes, or buying better fixtures and paying the difference between the fixture cost and the fixture allowance."

Customers look for more

There has been a definite step-up in the quality of fixtures being installed in contract-built homes since the company opened its new store, thus enabling women to select their own fixtures under favorable display conditions.

Although some smaller electrical contractors still prefer to stock a few fixtures and sell others on individual order, more and more of them are finding the Carter fixture stock and display more satisfactory than trying to handle their own. The company allows a modest discount to legitimate electrical contractors who choose to use the Carter fixture stock in preference to carrying their own.

Of course a continuing source of fixture business is the sale of fixtures in connection with the company's own electrical contracts. Mr. Carter has found that even in this type of business, the new sales and display room is an aid to fixture selling, since he can bring his customers in and permit them to make their own selections. And because there is such a wide variety of fixtures from which to choose, the average customer has a tendency to upgrade his fixture choice and consequently the amount included in the contract for fixtures generally is more than if the customer had simply made a flat allowance for fixtures, leaving selection up to the Carter contracting operation.

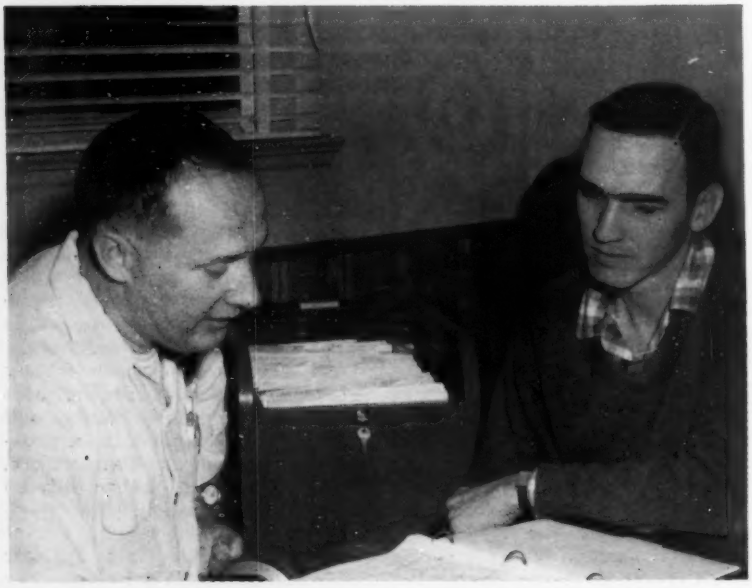
As an added attraction, and to break the monotony of sameness of wall area, the company has installed a strip of pegboard five feet high across the side of the back wall as seen from the reception desk near the entrance. This strip is painted to contrast with the light wall surface. Special type and novelty fixtures are displayed from this strip.

"The electrical contractor is the logical one to sell lighting fixtures," Mr. Carter emphasizes, "and, if our experience is any guide, he can do it. But he must provide as inviting a display and as wide an assortment as the prospect can find in any fixture store, if he expects to capitalize fully on his favorable position."

Eight years ago Mr. Carter opened his contracting business with one truck and one electrician. Today volume demands the use of 15 trucks and three two-way radio-equipped station wagons used by supervisors.

Good system, close supervision—

Close supervision begins in the office and spills over into every detail of work. Norris Cranmer, left, checks a job's record with his partner, William C. Moats. A complete record is made of every job from beginning to end, including the reasons for any delay in completion, and specifications of any changes made.



Job records provide a selling point for new customers. Here Mr. Cranmer shows a customer how his firm operates to give quality work. Calls and appointments are handled the same day they are made.

By Harry J. Miller

This article should be especially helpful to the following readers:

- Electrical Contractors ✓
- Electrical Utilities ✓
- Electrical Wholesalers ✓
- Electrical Inspectors
- Industrial Engineers
- Consulting Engineers

◆ "YOU DARE NOT send even your very best men out on a job—however well-trained they may be—and expect them to think for you. That's a job for management.

"No job builds itself; it needs the closest kind of supervision to make it come out profitwise and the way you had in mind when you submitted your bid on it. Anything less than continuous supervision before the job's beginning and all the way through to its finish, is courting ruinous trouble!"

So says Tampa Contractor Norris Cranmer, whose company, Cranmer Enterprises, Inc., began from scratch only a few years ago, and now numbers among its customers builders of fine homes for whom Cranmer does more than $50,000 worth of wiring a year. At the moment, this fledgling enterprise has a corner on the wiring of homes in the $60,000 bracket and is contemplating removal to new and more spacious office and shop facilities.

Start with right materials

In his belief that it's poor planning to simply load up a truck with material and dispatch a journeyman to a job before making sure he has what he needs to install the work as the office planned it, Mr. Cranmer insists on a material check list by his stockman. This individual is charged with the responsibility of making sure the needed supplies are aboard.

"We write the job up on a charge sheet," says the contractor, "and a separate charge tally is made for all subsequent changes or alterations of the original job.

formula for contractor's growth

There is also a record of every payment made and these records are kept in a folder which contains the entire history of the job from start to finish, for future reference."

The checklists on the trucks are examined on a weekly basis, when the specific supplies that make up their complements are replenished. This is in addition to the kinds and amounts of material normally stocked in each truck to answer the needs of run-of-the-mill daily service work. If a job is held up for any reason, then the material allocated to it is returned to the bins in the stockroom.

Salesmen-estimators lay out each job and make up the material lists. With this method of keeping supplies aboard each truck, a journeyman sent to handle a specific wiring job can also cover service calls along his route. Thus does supervision begin at Cranmer's office and stockroom level. And it extends on out to every facet of the job.

On-the-job supervision

"Our supervisor gets out to the job at the start of the rough in," says Mr. Cranmer. "He's there when this is ready for finishing, to catch any missing items and have everything ready for inspection." (In this connection it is interesting to note that electrical inspectors deplore the neglect which characterizes some jobs in that minor work, like the attachment of a ground clamp or the absence of a single fixture on an outlet, prevents final inspection, and results in delay and added expense to the contractor.)

By the application of rigid supervisior, the Cranmer firm has so enlisted the loyalty of its building contractor customers that competing firms have small opportunity to oust Cranmer from their good graces.

"Reason is we engineer every job to insure the satisfaction of the builder and/or his customer. We stress follow-through to make sure of a quality installation, using materials and workmanship that will stand up after the house

(Continued on page 136)

Wiring homes in the upper income bracket, such as these, offers a challenge to the electrician to exercise his ingenuity and turn out a quality job, says Norris Cranmer, whose company, Cranmer Enterprises, Inc., makes an effort to maintain such standards.

Contractors tell how

Reducing costs on remodeling jobs

By Earl G. Bennison
Bennison Electric Co.
Annandale, Va.

◆ AN OLD OFFICE building, originally converted years ago from two residences, where steady expansion had necessitated increasing the power load as floors were added, had to be brought up to present-day lighting standards when a 5000-sq. ft. addition was constructed for medical and other professional offices.

Contracting to design and engineer the service to accommodate the individual needs of its professional tenants, we had to completely rewire the old as well as the new sections increasing service from 100-ampere, three-phase to 600-ampere three-phase parallel service.

A pharmacy on the street floor of the building had its own specified needs. Installing an acoustical tile ceiling to reduce the noise level, we had to design the ceiling around the electrical fixtures, dropping the ceiling six inches. Using 2-foot x 4-foot tile, which is easy to remove and replace, we found this size exactly equaled lighting fixture dimensions and facilitated rearrangement of units.

Since the pharmacy was planned to have power to each counter as well as a number of direct line telephones to physicians, we installed adjustable floor boxes for telephone and electrical outlets.

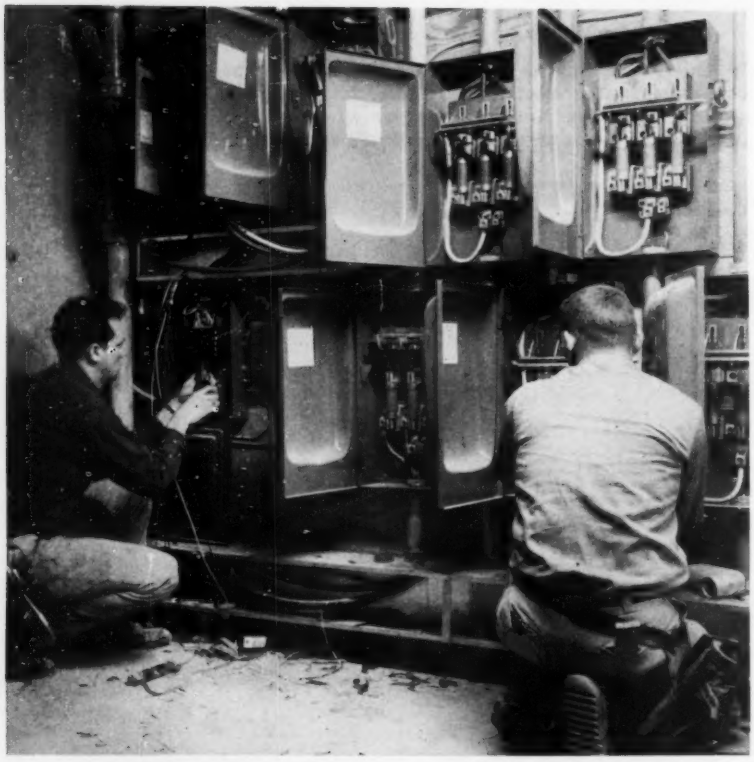
We installed heat pumps with auxiliary heaters on the roof, and a thermostat in each of the four heat pumps. A drop to 20 degrees activates the auxiliary heater to maintain temperature in the building. This unit becomes an air conditioner in warm weather.

To hold down costs, we removed the electrical fixtures of the old building and reinstalled them in recesses built for a luminous ceiling planned to give diffused lighting.

In the course of carrying out our job we used electric hammers in many instances and an electric winch to hoist the heat pumps and conduit to the roof. We have found that a set of telephones hooked up to communicate between floors or

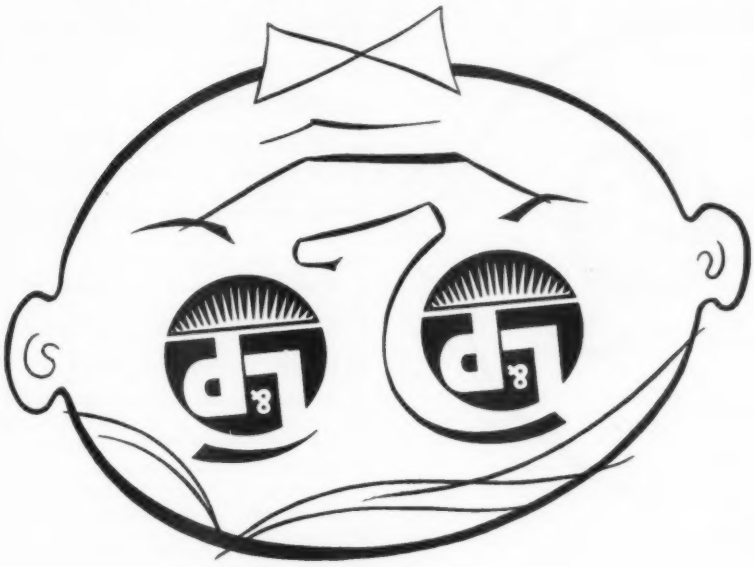
Tiles in this suspended acoustical ceiling are easily removed and replaced for access to fixtures.

Jack Canard and Richard Showers make adjustments at floor boxes for pharmacy counter power.



The electricians above are tying in a breaker in a 600-ampere, 3-phase parallel service. A professional building for physicians was increased from service of 100-amperes, 3-phase, to 600 amperes.

Lighting Fixtures Got You...



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Olive Branch, Miss.

between street area and building interior when we were working on a job is a wonderful time and step-saver. Using an old handset we have remodeled, the men string wire through the building and thus keep in touch with one another without running up and down the stairs of the building. Wherever two jobs are going on simultaneously at a distance from each other, the telephones bridge the gap.

Contractor cuts costs with more efficient wire puller

By W. U. McCoy

◆ A FEW YEARS ago Carpenter Electric Co., of Oklahoma City, had a tough re-wiring job. It took a week's effort by several men and cost Edward F. Carpenter $800 to pull the wire. Mr. Carpenter thought it was high time somebody did something about devising a better way to tackle such a problem, and went to work on it.

Recently a job similar to that week-long tough one came up. This time it took 45 minutes. In the intervening five years Mr. Carpenter had perfected a wire-pulling device which has done every job required of it—from the smallest to the 10-pound per foot variety—and which Mr. Carpenter says will handle anything a contractor is likely to run into. He pointed to a recent job where the machine pulled 70 feet of underground cable which had five 90-degree turns. He recently loaned the machine out to an electrician who had the job of pulling all wiring in a large hotel and told the electrician, "Tear it up if you can." The job was handled in record time, and Mr. Carpenter has a confirmed booster for his machine.

Another recent job which had an estimate of four days' labor Mr. Carpenter did in half a day; and the contractor says his device was responsible for much of the wiring savings on the Asbestos Cement Research House which had its unveiling in Oklahoma City a short time back.

"It has paid for itself any number of times on single jobs," Mr. Carpenter said.

The device is compact and portable, weighing only 100 pounds and measuring 11 x 20 inches and standing only 18 inches high. It is powered by a ⅓ horsepower motor, and geared to run a smooth and even five feet per minute; which, Mr. Carpenter points out, does not strip insulation, and allows the operator plenty of time to handle kinks, soapstone for cable in rusted conduits, or any other task that comes up. A lever on the side controls forward, neutral, or reverse action of the winding spool on top of the machine.

In tests the machine has broken cable rated at 6,000 pound pull, and once, in the experimental period, pulled a set of pipes right on out of the ground!

It may be handled easily by one man and used in almost any position or angle. The real secret lies in the bracket arms and pipe connections. The pull is against the end of the pipe itself.

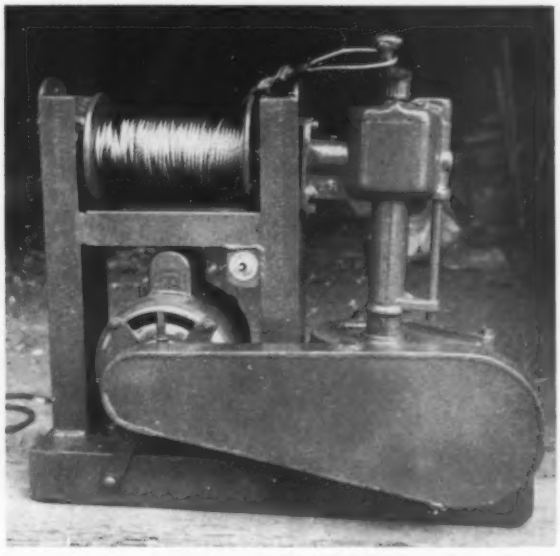
Two adjustable steel arms reach from the top of the machine and hold a steel plate which is bracketed around the pipe from which the cable is to be drawn. Thus all strain is evenly directed to that point at the end of the pipe, with no pressure or strain at any other place.

Mr. Carpenter has made a series of steel plates which fit around pipes, from the smallest up to a six-inch spread—each of which works equally well between the bracket arms at the pipe ends.

"I don't see how you could beat

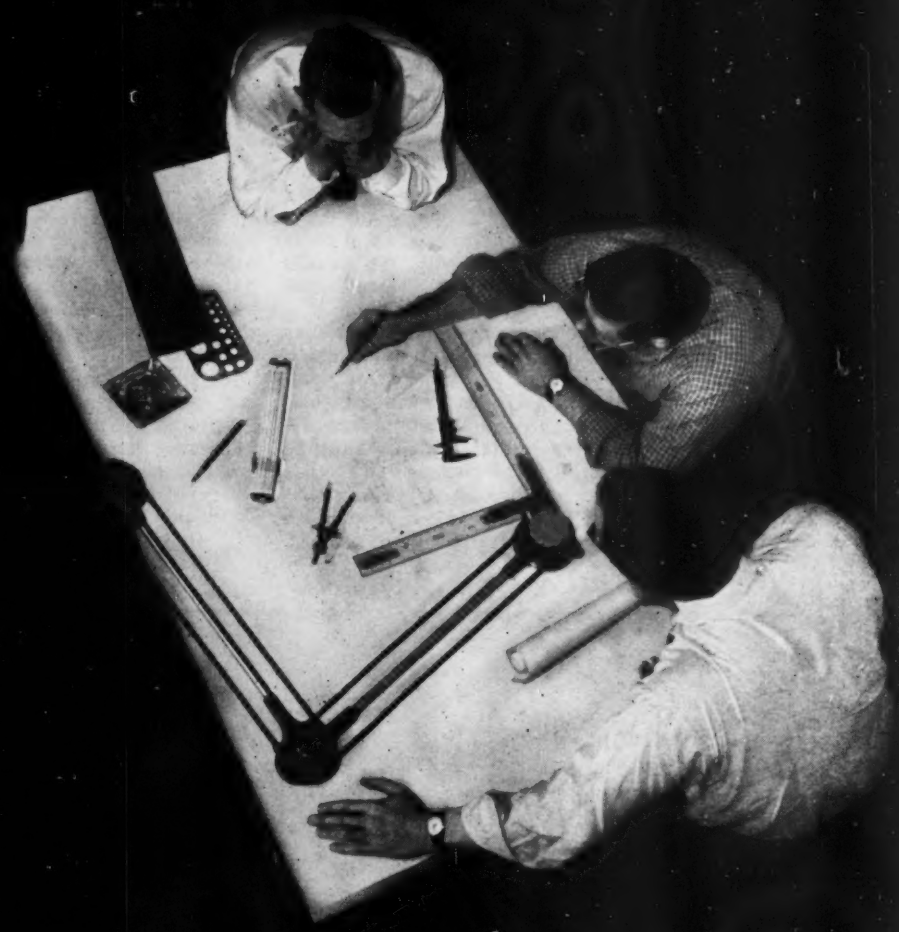
(Continued on page 132)

Edward Carpenter, right, and his son, James, show the new wire puller in action. Note the bracket arms and steel plate attachment to end of pipe, putting all stress on end of pipe.



This close-up of the wire pulling device designed by Oklahoma City contractor, Edward Carpenter, shows its compactness. Weighing only 100 pounds, it can be handled by one man from any angle.

CONCENTRATION



RT&E was founded and operates today on a very basic premise: do one thing and do it better than anyone else. That's why you'll find engineers at RT&E thinking and doing things with transformers that nobody else has ever done . . . why engineering talent at RT&E is concentrated on *one* idea . . . a better transformer. This concentration can pay off for you. Proof? Write for Bulletin 101.

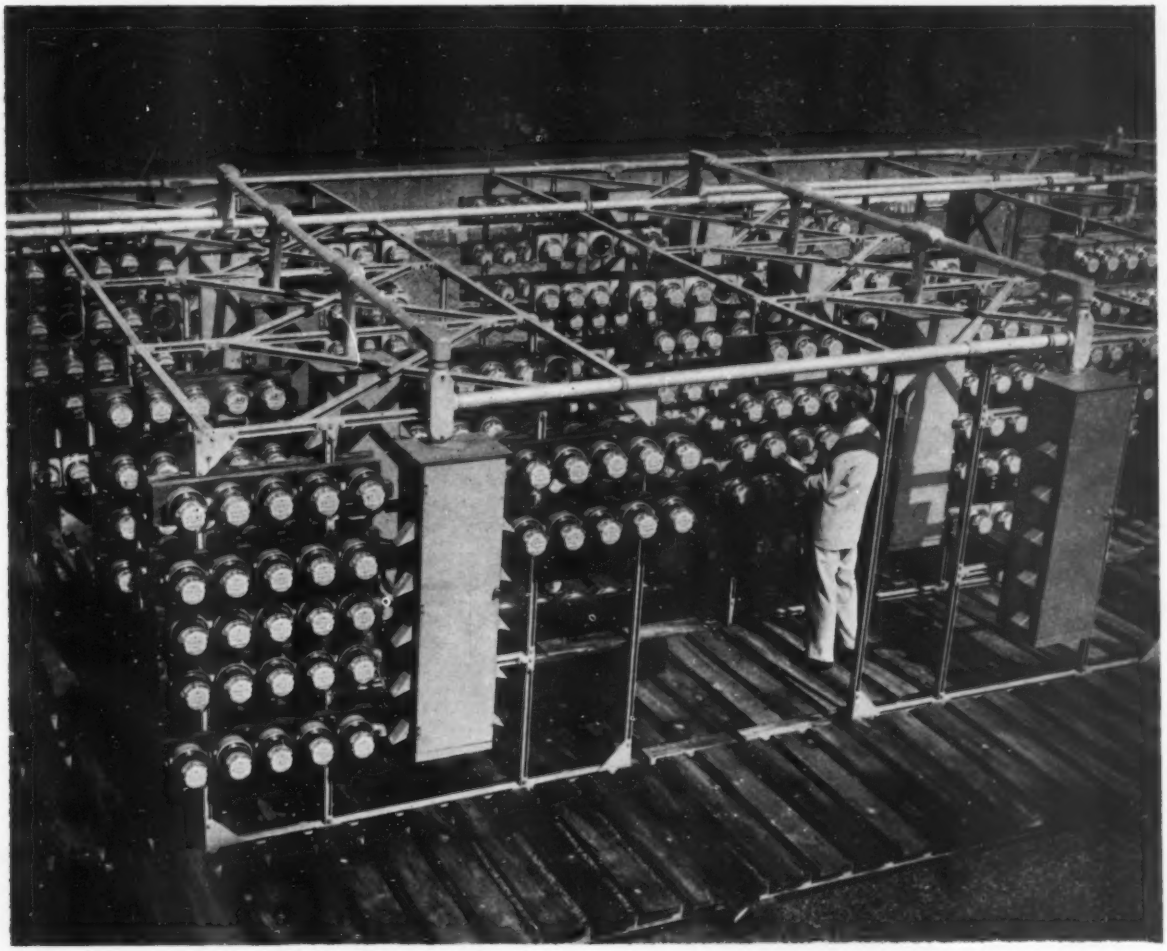
RT&E Corporation · Waukesha, Wisconsin · Portland, Oregon · Arlington, Texas

UTILITY ENGINEERING

Transmission — Distribution — Metering

Design
Installation

Testing
Maintenance

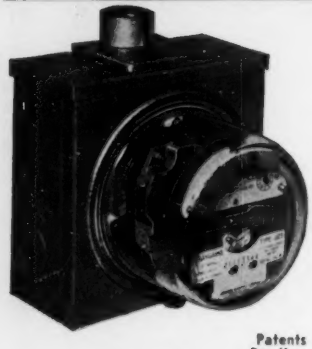


This outdoor test of G-E magnetic suspension meters has been in progress since 1940

Statistical evaluations of metering accuracy—page 88
Cluster mounting for metering equipment—page 92
Why not hermetically-sealed watthour meters?—page 93
New meters offer magnetic repulsion bearings—page 94
New look in protective relaying equipment—page 98
Conductor heat dissipation, Part 5—page 101

Patents Pending

CATALOG WVL-0150A-2"
Size 10½" x 8" x 3⅝"
Up to 150 Amp. Capacity



Patents Pending

CATALOG WV-011-A-1¼"
Size 8" x 8" x 3⅝"
Up to 100 Amp. Capacity

LOOKING for Something? Designed for the Application

B & C'S ORIGINAL RINGLESS METER SOCKETS

LIGHT DUTY, MEDIUM DUTY, HEAVY DUTY SOCKETS

SINGLEPHASE, POLYPHASE, COMBINATION DEVICES

HORIZONTAL GANG, VERTICAL GANG, SOCKET UNITS

INDOOR AND OUTDOOR TRANSFORMER CABINETS

COMBINATION TRANSFORMER - METER ENCLOSURES

UNIQUE TRANSFORMER MOUNTING BRACKETS

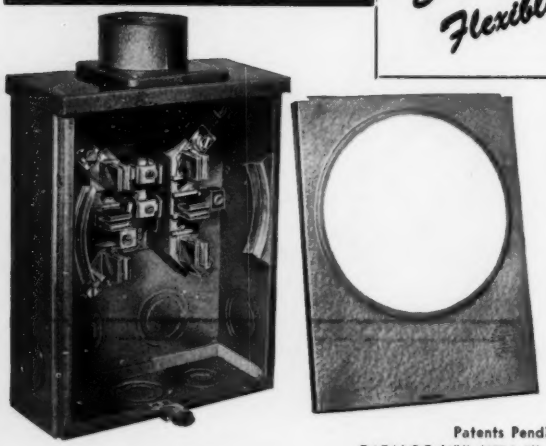
OUTDOOR AND INDOOR METERING ENCLOSURES

SERVICE MAST CLAMPS AND OTHER ACCESSORIES

INDOOR AND OUTDOOR METER CONNECTING CABINETS

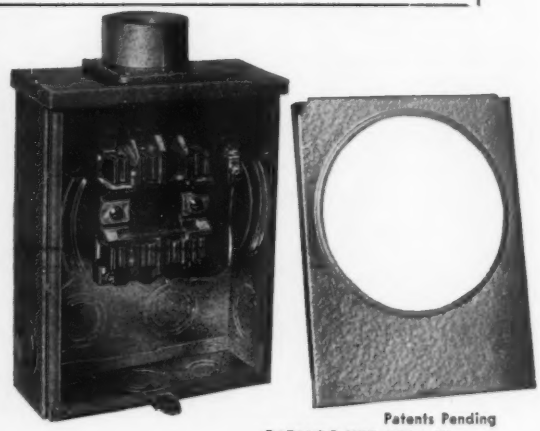
METER SOCKET ACCESSORIES, PARTS, SPECIAL DEVICES

B & C's Revolutionary, Unique, Designs Flexible, and Unexcelled in Performance Keeping Pace With the Electrical Industry



Patents Pending

CATALOG WVL-0175A-2"
Size 10½" x 8" x 3⅝"
175 Ampere Capacity
3-Gang Ground
5th and 6th Terminals
Added Line Terminals for
connection to other sockets



Patents Pending

CATALOG WVL-1007-A-2"
Size 10½" x 8" x 3⅝"
7-Terminals — 100 Amp. Capacity

Write for descriptive catalog containing installation data and current price list.

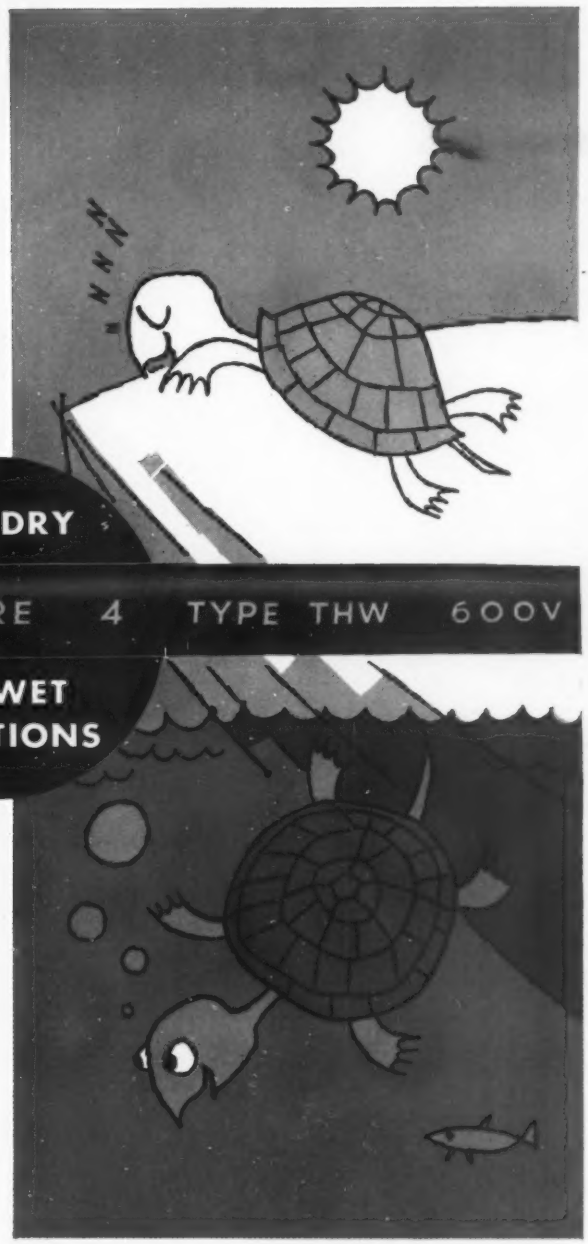
B and C

Your Seal of Dependability and Safety

METAL STAMPING COMPANY

590 MEANS ST., N. W. • ATLANTA, GEORGIA

Order Southwire **THW** Building Wire



Demand is as high as Ben Franklin's kite for new Southwire THW Building Wire. No wonder. Look what it has to offer:

- *Costs less to buy*
- *Costs less to install*
- *Weighs less*
- *Easy Pulling—lubricated surface*
- *75° C rating—wet or dry locations*
- *Carries more amperes per unit of costs and weight*
- *Comes in any solid color*
- *UL approved, of course*

When you order Southwire THW, you get Southwire service at no extra cost. Write, wire or phone today!

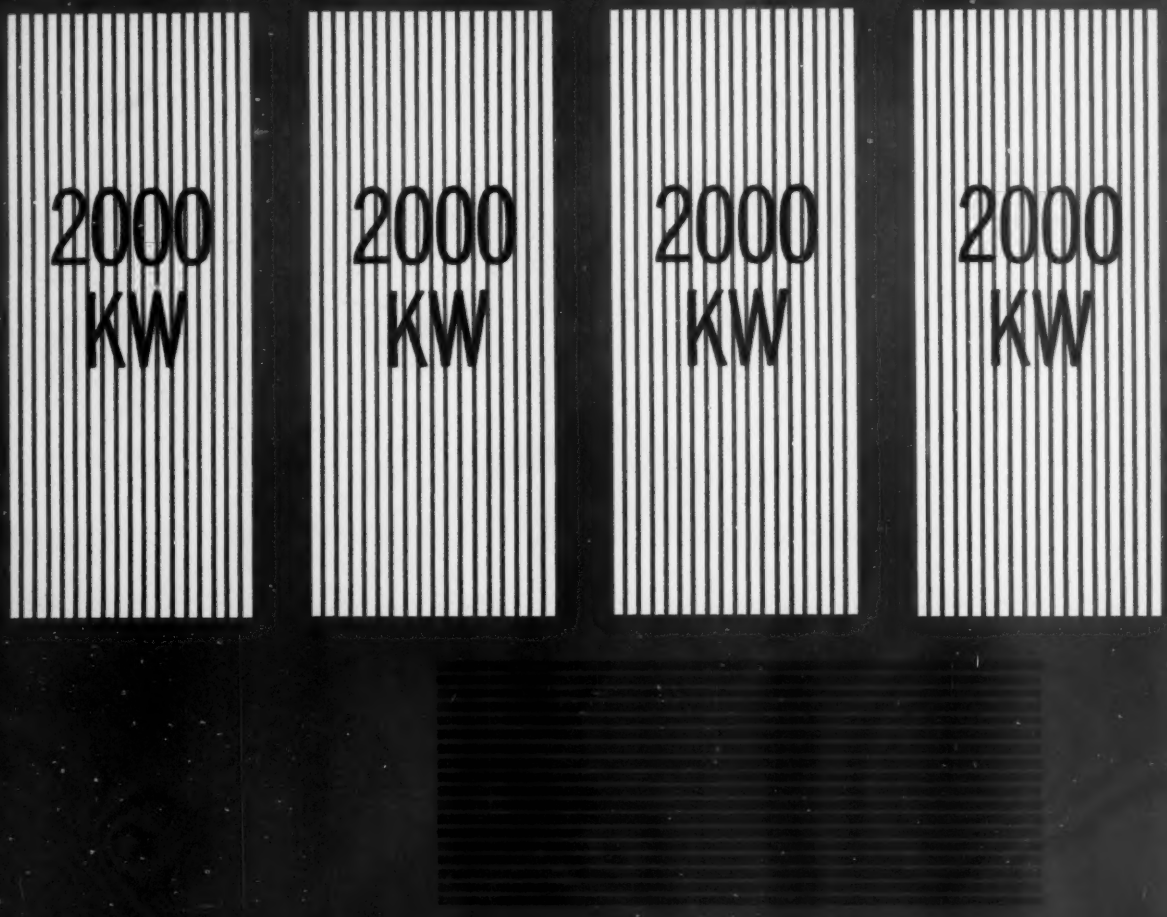
Southwire Company

Carrollton, Georgia—TErrace 2-6311

SOUTHWIRE serves the world

ALUMINUM • COPPER • STEEL STRAND

- Bare and Weatherproof Copper and Aluminum Line Wire
- Neoprene, Polyethylene, and VWP* (Vinyl) Weatherproof Copper, Aluminum and Triplex
- U.R.C. (DBWP, TBWP) Copper
- Copperweld® Conductors
- Copper and Aluminum Building Wire
- ACSR and All Aluminum Cable
- Galvanized Steel Guy Strand and Static Wire
- Aluminized Steel Guy Strand and Static Wire
- Aluminum Alloy Wire
- Cable Accessories
- NM Sheathed Cable
- ALSO FABRICATORS OF COPPER AND ALUMINUM FOR WIRE AND CABLE MANUFACTURERS



Electro-Motive Peaking Plants

New MU-100 plant $82 per KW, F.O.B. Electro-Motive Factory

For those utilities seeking higher capacity peaking power, the new Electro-Motive 10,000 KW plant offers low investment per KW (as low as $94 per KW installed at site) plus new operating and control features not found on other types of equipment.

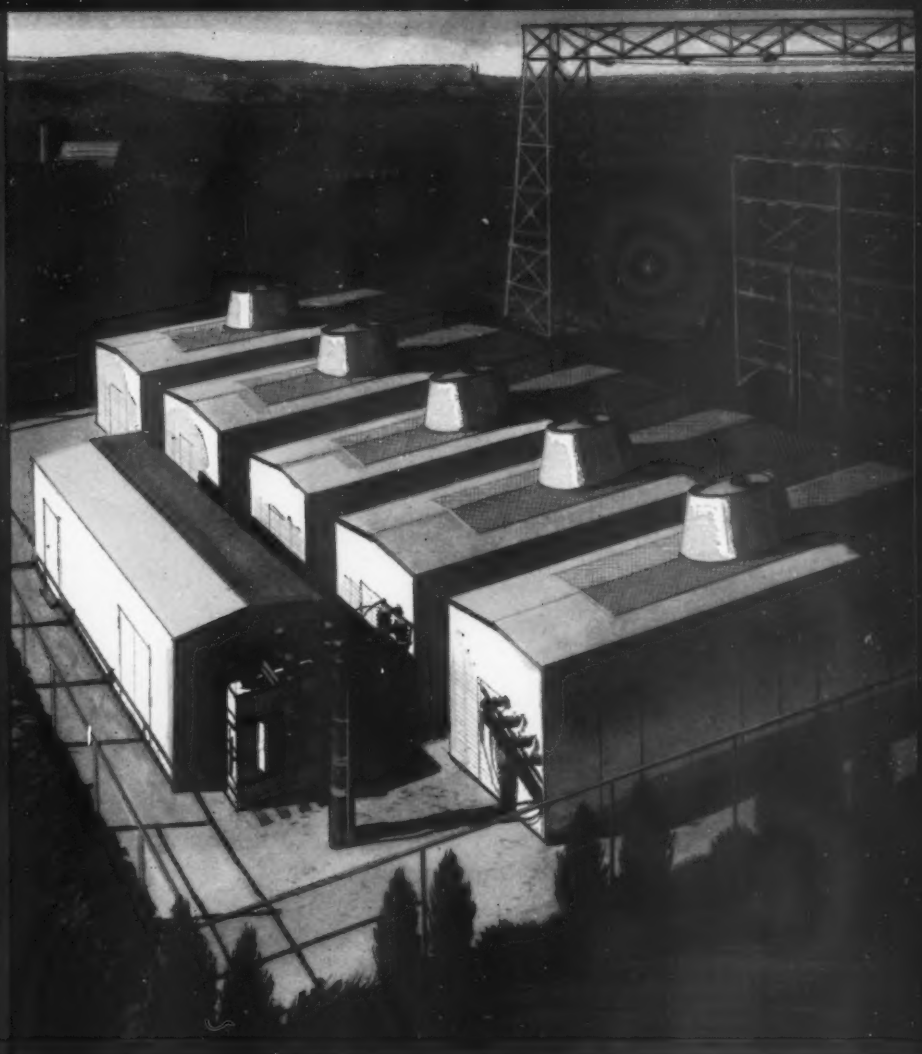
Highly flexible. The MU-100 may be utilized in peaking, reserve or area protection applications. It may be remotely operated by a variety of methods—automatically by voltage or current sensing devices, and by supervisory control such as leased telephone line or by carrier current. Self-contained design permits location at the step-down substation serving the load. Installation is simple and inexpensive, and the plant may be moved at any time to match changing load conditions.

Future expansion flexibility. Smaller Electro-Motive plants (2,000, 4,000, 6,000 and 8,000 KW) can be installed now with control equipment in place to expand later up to 10,000 KW.

By taking advantage of this plan-ahead feature, additional KW capacity can be added later for less than $75/KW *installed*. For example, total end cost for uprating from 2,000 KW to 8,000 KW is the same as the initial cost for an 8,000 KW plant.

New controls. The plant control contains many innovations which further extend flexibility. The plant may be operated remotely at various capacities to match load conditions. Each generator produces 2,000 KW—and each may be operated individually or

NOW
+
2000
KW



now available up to 10,000 KW

in any combination. Thus, the plant will provide 2,000, 4,000, 6,000, 8,000 or 10,000 KW. With selective control a block of power is always available—even during maintenance.

Fast start. From a cold start, the MU-100 is on line carrying load in less than three and one-half minutes. A spinning reserve start has been designed into the plant which reduces starting time to a minute and a half.

With the addition of the MU-100 to the Electro-Motive line, the most complete range of capacities is available in specialized peaking equipment. Thus it is possible to match capacity to need for the most efficient operation and lowest investment. An increase in demand is handled by expanding the plant—at low incremental cost—with additional generating components.

An analysis of utility peaking needs will reveal the savings possible with the application of Electro-Motive equipment. Ask the Electro-Motive representative for information.

ELECTRO-MOTIVE DIVISION
GENERAL MOTORS · LA GRANGE, ILLINOIS

Sales-engineering offices: Chicago, New York, St. Louis, San Francisco

In Canada: General Motors Diesel Limited, London, Ontario

MU-20 2000 KW Diesel
MU-14DF 1000 KW Dual-fuel

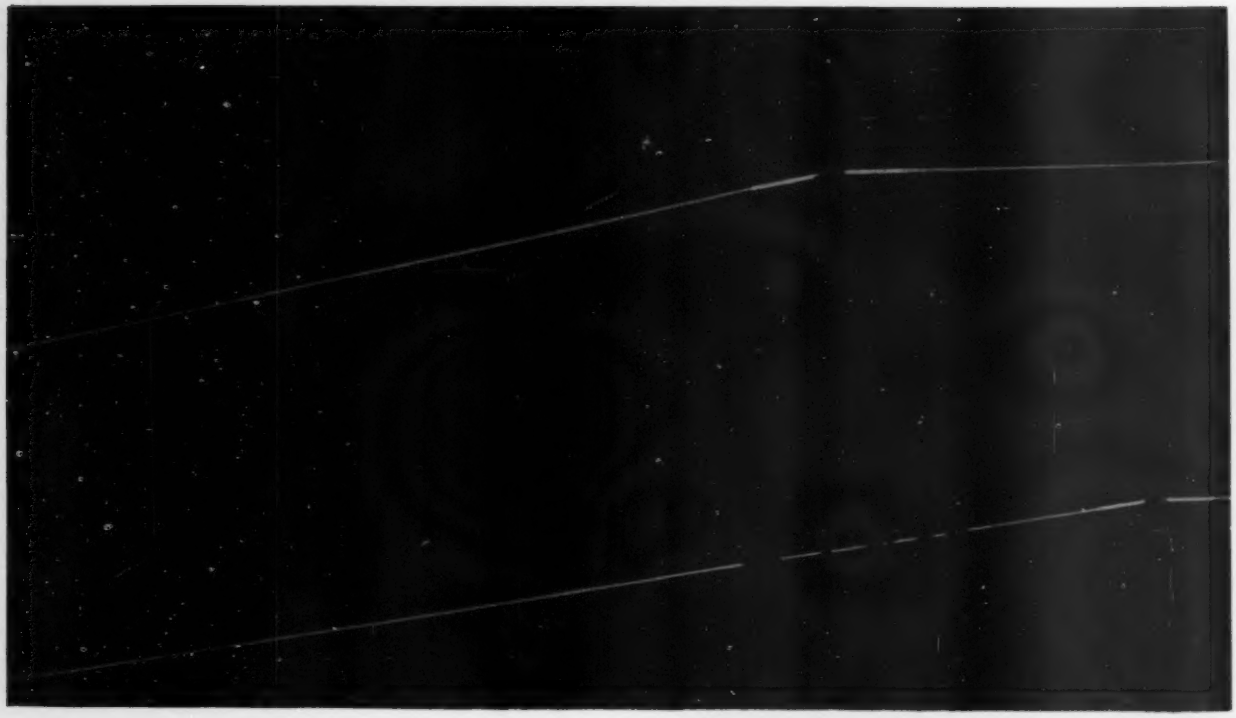
MU-40 4000 KW Diesel
MU-28DF 2000 KW Dual-fuel

MU-60 6000 KW Diesel
MU-42DF 3000 KW Dual-fuel

MU-80 8000 KW Diesel
MU-56DF 4000 KW Dual-fuel

MU-100 10,000 KW Diesel
MU-70DF 5000 KW Dual-fuel

Engineered to give your transmission lines



HERE'S WHY

ALUMOWELD OVERHEAD GROUND WIRE

IS THE MOST EFFECTIVE SHIELDING

FOR YOUR TRANSMISSION LINES

thick aluminum covering

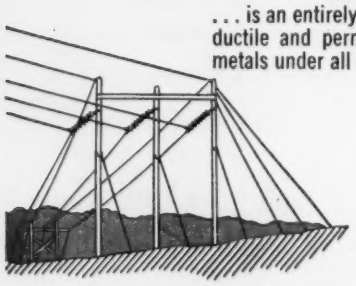
. . . provides 3 times the conductance of steel wire and the same corrosion resistance as solid aluminum wire. Alumoweld's heavy cladding of aluminum—25% by area—will not crack, flake or peel.

strong steel core

. . . gives Alumoweld the same rugged strength as extra-high-tensile steel wire, yet Alumoweld is 18% lighter in weight.

controlled atomic weld

. . . is an entirely new process which results in a ductile and permanent weld between the two metals under all operating conditions.



ALUMOWELD FOR GUY STRAND

Because Alumoweld is strong, easy to handle and will not rust, it is ideal for guying purposes.

Alumoweld is available for immediate delivery from our warehouses located in New York, Chicago, Pittsburgh and Memphis. Let us quote on your requirements for this low-cost strand.

BETTER PROTECTION–LONGER LIFE–at LOW COST...

NEW

ALUMOWELD

overhead ground wire

Alumoweld Overhead Ground Wire is in a class by itself! In addition to its superior mechanical and electrical properties, this new aluminum-covered steel wire offers the money-saving benefits of low original cost and lowest maintenance cost.

Having the rugged strength of extra-high-tensile steel wire, Alumoweld is 18% lighter in weight . . . has three times the conductance . . . and will last far longer. When compared to solid aluminum wire, Alumoweld has equal life, one third the conductivity, and eight times the strength.

Here's why Alumoweld pays off when used for overhead ground wire. Its high strength-to-weight ratio permits stringing with small sags for greater mid-span clearance. The excellent conductivity of Alumoweld assures proper operation of protective relays and effectively discharges lightning currents to ground. This greatly improves the stability and dependability of the system. Equally important is the long, trouble-free life that Alumoweld provides because of its ability to resist corrosion.

Engineering bulletin E.D. 3000 will bring you the complete story. Write for your copy today.

ALUMOWELD

COPPERWELD STEEL COMPANY

WIRE AND CABLE DIVISION

Glassport, Pa.

For Export: COPPERWELD STEEL INTERNATIONAL COMPANY, New York

ANOTHER STEP AHEAD IN VOLTAGE REGULATION

APPLICATION ENGINEERING

INSTALLATION SERVICE

LINE CREW TRAINING

RAPID PARTS SHIPMENT

These General Electric Voltage Regulator

SERVICES MEAN SAVINGS

Savings for you through economical application, installation, operation, and maintenance are a big part of General Electric's voltage regulator story.

When you buy reliable G-E regulators you receive these added values in service:

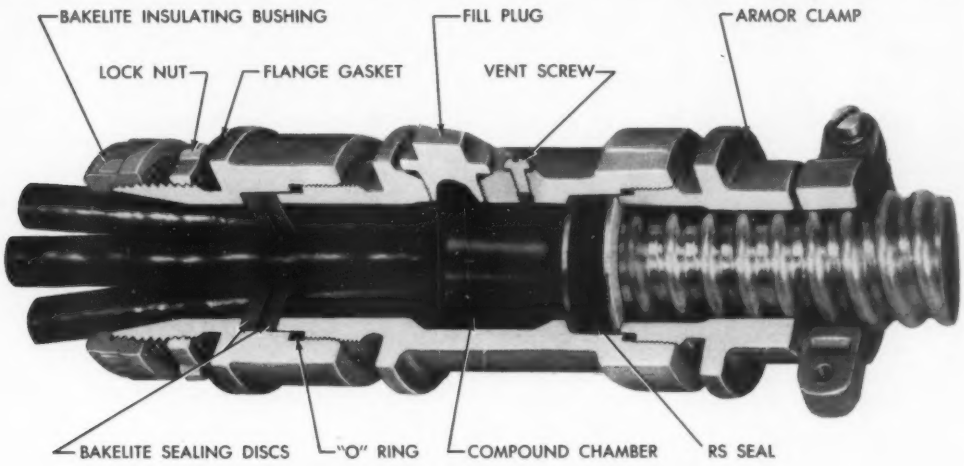
- Engineering assistance during planning stages of modern distribution systems gives you benefits of latest application concepts and computer-augmented system regulation studies.
- Installation guidance on-the-site by G-E regulator engineers assures proper hook-up, continued economical operation.
- Factory trained G-E personnel keep you informed of the latest regulator operation and maintenance techniques to save you money year after year.
- Rapid renewal parts shipment, within 48 hours on common replacement items, cuts outages to a minimum. Nationwide network of G-E service shops stays open 24 hours a day, 7 days a week to give service when you need it—and fast. Quick regulator delivery from *local* G-E warehouses helps you meet storm-caused emergencies.

Service that saves you money during planning, installation, and operation is another reason why General Electric regulators cost less on the line! Ask your G-E regulator representative for detailed information. General Electric Company, Schenectady 5, N. Y. 456-01

Progress Is Our Most Important Product

GENERAL ELECTRIC

New from the only manufacturer of *all* cable accessories . . .



G&W Series 800 Interlocked Armor Cable Fittings

. . . accommodate all commercially available interlocked armor cable
. . . reduce installation time and effort
. . . available for immediate delivery

New G&W Series 800 Fittings not only terminate, but support, ground, mount, and dead end on the widest variety of applications. They offer simplified, modern design in only four basic pipe sizes to accommodate all interlocked armor cable now being manufactured. Eight different fittings in each size means faster installation from simple armor clamps to compound-filled terminations used in any position.

CHECK THESE SIGNIFICANT FEATURES:

- **High strength aluminum parts**
- **Resistoyl® gaskets**
- **RS seals proven on potheads, boxes, and switches**
- **Interchangeable components**
- **Water-tight construction**

G&W's Series 800 Fittings are an important addition to the only complete line of cable accessories available . . . G&W also offers the *best* engineering information service to assist you in any of the following areas:

Potheads . . . Terminating Kits . . .

Splice Kits and Boxes . . . Joints . . .

All high and low voltage Cable Accessories

Further proof that you save time and money by relying on the dependability of G&W's constant product development. For the detailed story on the new Series 800 Fittings, mail the coupon below for your copy of Catalog H.

H60-T

G&W ELECTRIC SPECIALTY COMPANY
3524 West 127th Street • Blue Island, Illinois

☐ Send me a copy of Catalog H detailing facts about the new G&W Series 800 Interlocked Armor Cable Fittings.

I specify interlocked armor cable for the following applications:

_____

_____

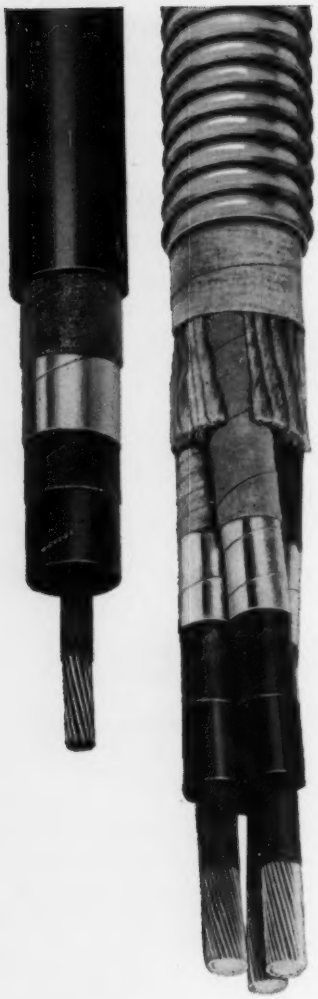
Name and Title: _____

Company: _____

Address: _____

City: _____ Zone: _____ State: _____

superior quality standards
— inspired specialized designs



how good should power cable be

...*for long term stability?*

It isn't enough to meet or barely surpass specifications—not when it is possible to build maximum performance into power cable—as Circle does. Take. for example, the IPCEA-NEMA 60 cycle water absorption test.

Circlesheath® Type RR Power Cable Performance

In the IPCEA-NEMA "Accelerated Water Absorption Tests," Section 6.9, a sample of power cable is immersed in 50°C water for a period of 14 days during and after which time specific inductive capacity and stability factor are measured.

Not only does Circle butyl-insulated power cable far surpass all minimum specifications after 14 days immersion—*but continues to do so after one year and eight months of continuous immersion. And the test is still going on!*

Date of original immersion: September 1958 Date of last test: April 1960

CABLE DESCRIPTION: 15KV, UNGROUNDED, SHIELDED	CIRCLESHEATH® CHANGE SIC	PERFORMANCE STABILITY FACTOR
700,000CM	4.3%	.6%
300,000CM	3.9%	.5%
300,000CM	3.6%	.4%

IPCEA-NEMA Requirements: Change SIC 1 to 14 days: 5% max.— stability factor after 14 days: 1% max.

The manufacture of high-reliability power cable is no accident. It requires expert knowledge of compounding techniques, absolute quality control—and production men who not only care enough . . . but *know enough* to produce the very best.

Circle CIRCLOC® Interlocked Armored Cable combines flexibility with mechanical protection in one lightweight, economical construction. It trains easily over obstructions; is ideal for future plant expansion. Available in galvanized steel, bronze or aluminum armor—from 600 to 15,000 volts.

CIRCLE WIRE & CABLE
a subsidiary of
CERRO DE PASCO CORPORATION

RUBBER COVERED WIRE & CABLE • VARNISHED CAMBRIC CABLE •
PLASTIC INSULATED CABLE • NEOPRENE SHEATHED CABLE • CIRTUBE* EMT

Kuhlman announces:

12% uprating OF ALL "POLE-TYPE" TRANSFORMERS

Featuring longer-life SPI-65* insulation with 65° rise

The new '60 dual-rated transformer includes an "ALL NEW" core and coil with better voltage regulation, more revenue per transformer, smaller, lighter, more efficient design.

Kuhlman transformers, known through the years for their high overload capacity, are now being uprated 12%. This means all "pole-type" ratings and medium power transformers through 10,000 KVA will have dual name plate ratings. For example, a transformer formerly rated 25 KVA provides 25 KVA performance at 55° temperature rise and 28 KVA performance at a 65° rise with no sacrifice in transformer life.

This uprating, which has been a performance fact for some time, is possible because of the excellent temperature rise characteristics inherent in all Kuhlman transformers. Now, longer-life SPI-65* insulation has also been added. The combination of inherent low temperature rise and SPI-65* provides both uprating and longer life to suit the loading practices that best meet your needs.

No longer is it necessary to choose between inherent thermal characteristics and super insulation. Kuhlman now offers both in one design. Ask your Kuhlman representative to show you why now, more than ever, your transformer dollar goes farther with Kuhlman.

*Licensed under Westinghouse Insuldur® patent rights.

KUHLMAN TRANSFORMERS

KUHLMAN ELECTRIC COMPANY, Birmingham, Mich.
Manufacturers of transformers since 1894
Southern Division: CRYSTAL SPRINGS, MISSISSIPPI

20 years beneath the sidewalks of New York

USS Tiger Brand Paper-Lead Cable

Like most utilities, Consolidated Edison of New York City, is engaged in an endless race to keep up with the growing demand for electric power.

In the Williamsburg section of Brooklyn, new USS Tiger Brand Paper-Lead Cables were installed to replace some of the existing ones that were being removed, due to system rearrangement, after 20 years or more of service. In some areas, the new cables were an addition rather than a replacement. The old cables were still giving good service but additional capacity was needed.

USS Tiger Brand paper-insulated, lead-sheath cables are noted for their reliability. More than 56,000 feet were used by Consolidated Edison in recent expansion programs. Engineering specifications called for 2/0, 27 KV, 3-conductor cable in carefully predetermined lengths for the Williamsburg section.

For high-voltage feeders, USS Tiger Brand Paper Insulated Cable is available in solid or gas-filled types. Many special constructions are available as standard production. An inquiry detailing your requirements will receive our prompt and careful attention. Write American Steel & Wire, 614 Superior Ave., N.W., Cleveland 13, Ohio.

USS and Tiger Brand are registered trademarks

USS Tiger Brand Electrical Wire & Cable —A standard cable for every special job

Asbestos Wire and Cable • Varnished Cambric Cable • Mold-Cured Portable Cord • Interlocked Armor Cable • Shovel & Dredge Cable • Special Purpose Wire & Cable • Paper & Lead Cable • Aerial, Underground and Submarine Cable

American Steel & Wire Division of United States Steel

Columbia-Geneva Steel Division, San Francisco, Pacific Coast Distributors • Tennessee Coal & Iron Division, Fairfield, Ala., Southern Distributors • United States Steel Export Company, Distributors Abroad

Power boost for Williamsburg area. Crew makes a 393-foot pull applying lubrication on the new Tiger Brand Cable as it is fed into the underground duct.

"Zingo! she's done"...describes why

THE BEST COSTS LESS INSTALLED

"Zingo, she's done", is the way Ray Kunkle, on-the-job foreman, Dave Speaker Company, electrical contractors of Kenosha, Wisconsin, describes Republic "INCH-MARKED" ELECTRUNITE® E.M.T.

In discussing the easy wire pulling qualities of ELECTRUNITE's exclusive "INSIDE-KNURLING", Ray said: *"Pulling a pair of #8's and a #10 over tight bends is a lot easier with the Silverslick inside finish. You can feel the difference."*

Buy and try Republic ELECTRUNITE E.M.T. on your next job. These ease of installation advantages can be yours. Call your Republic representative. Or, write direct.

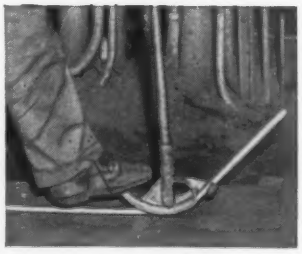
REPUBLIC STEEL

STEEL AND TUBES DIVISION

Cleveland 8, Ohio

REPUBLIC ELECTRUNITE® E.M.T. is produced from highest quality flat-rolled, open-hearth steel, controlled by Republic through every step of manufacturing from ore to finished product. ELECTRUNITE E.M.T. was used in the construction of the new Y.M.C.A. Building, Racine, Wisconsin. Architects: Grassold-Johnson, Associates, Racine, Wisconsin. Electrical Contractor: Dave Speaker Company, Kenosha, Wisconsin.

"We needed a 14-inch right angle bend so that there would be enough stubbing after the concrete pour. "INCH-MARKS" make it easy. Just check off 14" and subtract the bender allowance. Put the bender on the mark and zingo, she's done." That's the way Ray Kunkle describes ELECTRUNITE's "INCH-MARKED"® and "GUIDE-LINED"® features.



ELECTRUNITE's tightly adhering galvanized coating protects against corrosion—won't peel, chip, or flake off during bending. Resists galvanic action. Millions of feet have been successfully used in slab concrete installations over the past twenty-five years. Still in service, ready for more service tomorrow.

ARE YOU TAKING ADVANTAGE OF THE ADDED KVA CAPACITY OF GENERAL ELECTRIC'S 55°◎65° DISTRIBUTION TRANSFORMERS?

GENERAL ELECTRIC

55° 65°
75/84
37.5/42
50/56
100/112
15/16.8
5/5.6
10/11.2
25/28

Why settle for less, when . . .

General Electric Transformers give you added KVA, with the same operating life– at no price premium

Major insulation development provides 12 percent more kva capacity. Here are the facts . . .

General Electric's complete line of oil-filled 55°●65° distribution transformers provides 12 percent more kva capacity—at no price increase or loss in normal operating life. This added capacity is made possible by using Permalex* insulation—a major innovation in transformer insulation systems which was developed by General Electric and is used in oil-filled distribution transformers.

The use of superior Permalex insulation permits transformer operation at higher average winding rise (65 C) without loss of normal operating life. This means you can carry 12 percent more kva with General Electric Permalex insulated transformers.

Every General Electric 55°●65° transformer has a second nameplate kva rating. The new, higher rating reflects the 12 percent kva increase—allowing you to utilize the added capacity within your established loading practices. *And the new rating retains the same design margin between stated temperature rise and actual rise—consistent with traditional General Electric distribution-transformer design practices.*

General Electric's new approach to greater kva capacity is accomplished through advanced interior transformer design. Permalex transformers retain the same small size and light weight—but with substantially increased kva capacity.

Before you buy another transformer, ask your G-E Sales Engineer to show you the story of the 55°●65° transformer. It takes just a few minutes and can save you many dollars in transformer investment and operation. Or, write for more information to Section 482-08, General Electric Co., Schenectady, N. Y.

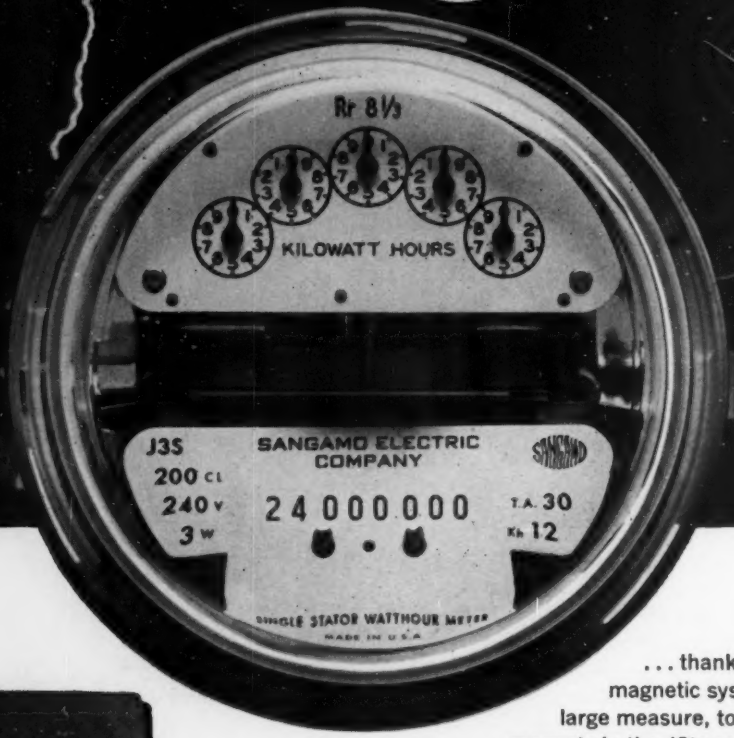
*Trademark of General Electric Co.

Progress Is Our Most Important Product

GENERAL ELECTRIC

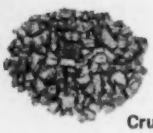
COMPLETE LINE OF 55°●65° POLE-TYPE TRANSFORMERS now available from G-E warehouses across the country. Instrumental in the development of this new transformer design were Dr. R. Flowers, insulation laboratory chemist and co-inventor of patented cyanoethylated kraft; J. Silverstein (front), Product Planning Specialist; and J. Leslie, insulation laboratory chemist.

THE SANGAMO J3 SHRUGS OFF SURGES



. . . thanks to the permanence and stability of its magnetic system. Permanence and stability due, in large measure, to the high quality and uniformity of the magnets in the J3's controlled floating system.

Alnico as received



Crushed

Ground

Bonded Alnico Magnets

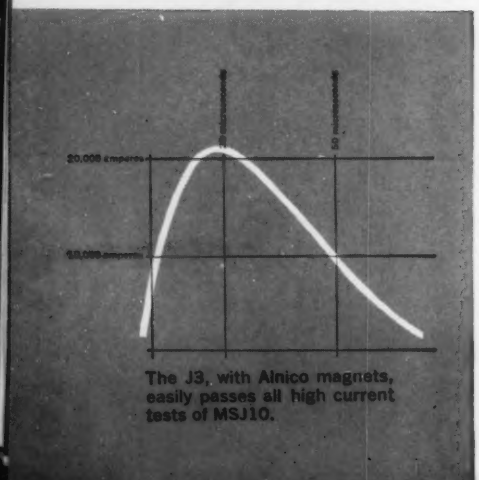
These magnets are made by Sangamo. Made of bonded Alnico. Extra-high coercive force Alnico material is crushed and ground into a fine powder, then bonded into magnets . . . dimensionally and magnetically uniform magnets that have none of the variable characteristics associated with cast and sintered magnets. Each magnet is also thoroughly factory-aged to make sure its strength will not diminish through long years of service.

Actually, all of the components of the J3 are virtually unaffected by high surge currents—even after repeated surges of 20,000 amperes through the neutral wire and 2,000 amperes through the current coils. This includes the electromagnets as well as the Alnico floating system and damping magnets. Surges and short circuits which can de-magnetize even the best chrome steel magnets can't affect the J3 Alnico magnets.

The true magnetic floating system of the J3 never requires maintenance or replacement and is guaranteed for the life of the meter. That's just one of many good reasons why the J3 is your best investment in watthour meters.

Other reasons? A visible, self-cleaning gap; substantially reduced side thrust; insignificant tilt error; advanced insulation level; smallest size; better visibility for inspection and testing; highest torque; slowest speed; lowest watts loss; sectionalized construction; corrosion-resistant finishes and materials; glaskyd base.

Your Sangamo Representative has the complete J3 story. Get it; you'll discover that the J3 has everything you want in a watthour meter. And that's a promise, for this is one of the really great ones.



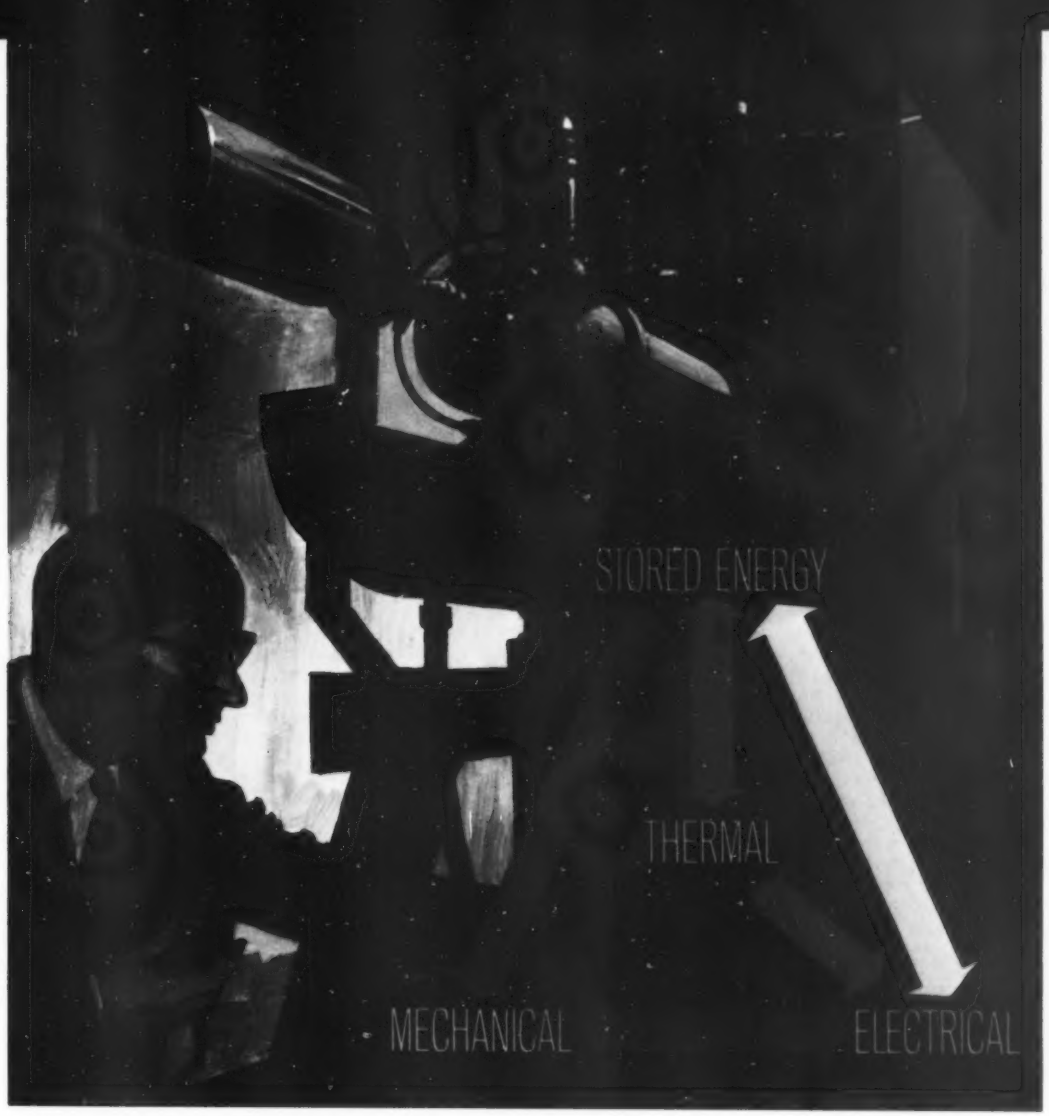
The J3, with Alnico magnets, easily passes all high current tests of MSJ10.

SANGAMO ELECTRIC COMPANY

SPRINGFIELD, ILLINOIS

J3

JH60-9



WESTINGHOUSE POWERCASTING*

probes four promising new power sources

Direct conversion methods promise high efficiency, low capital cost per kw

It is a certainty that the electric utility industry will utilize sources of power beyond conventional steam generation . . . and within the predictable future. For this reason, Westinghouse has for many years been engaged in an intensive program to develop methods of producing electric power by direct conversion. This program is broad front . . . all known possibilities are being investigated. Each of 38 Westinghouse laboratories is working on some phase of the problem. Many of these investigations are being initiated from a fund of pure knowledge gained through—and possible only because of—Westinghouse year-in, year-out program of basic research.

Development of advanced methods of power generation is being carried out to reduce, still further, the cost of generating electricity. They are being developed through the continuous search for economical generation for the future.

Four of these future power sources, Westinghouse believes, are standout possibilities . . . the fuel cell, thermionic, thermoelectric and magnetohydrodynamic generators.

*A Service-Mark of Westinghouse

YOU CAN BE SURE...IF IT'S Westinghouse

WESTINGHOUSE POWERCASTING* foresees efficiency gains up 80% for fuel cell...challenges role of steam turbine-genera

2 TO 1, YOU'LL HAVE ONE OF THESE NEW POWER SOURCES ON YOUR SYS

Fuel cell base load generator potentially twice as efficient as today's turbine-generator

The fuel cell probably will be able to produce twice the power, per unit of fuel, as today's most efficient steam generator. This staggering potential has prompted an intensive effort at Westinghouse to develop this system.

The energy released by the chemical reaction between a fuel and an oxidant is converted directly to electrical energy by the action of the fuel cell. The simple picture of a cell mechanism is an electrolyte sandwiched between two electrodes. An oxidant—usually oxygen—is supplied to one electrode where oxygen ions are formed. The ions move through the electrolyte to the second electrode where chemical combination occurs with the fuel. Electric power is obtained by connecting a load between the electrodes.

One prime reason for considering the fuel cell as a potential replacement for steam generation is the elimination of moving parts. Another is that efficiency is independent of the size of cell over a wide range of power output. The same fossil fuels can be used more efficiently and without the necessity of a heat

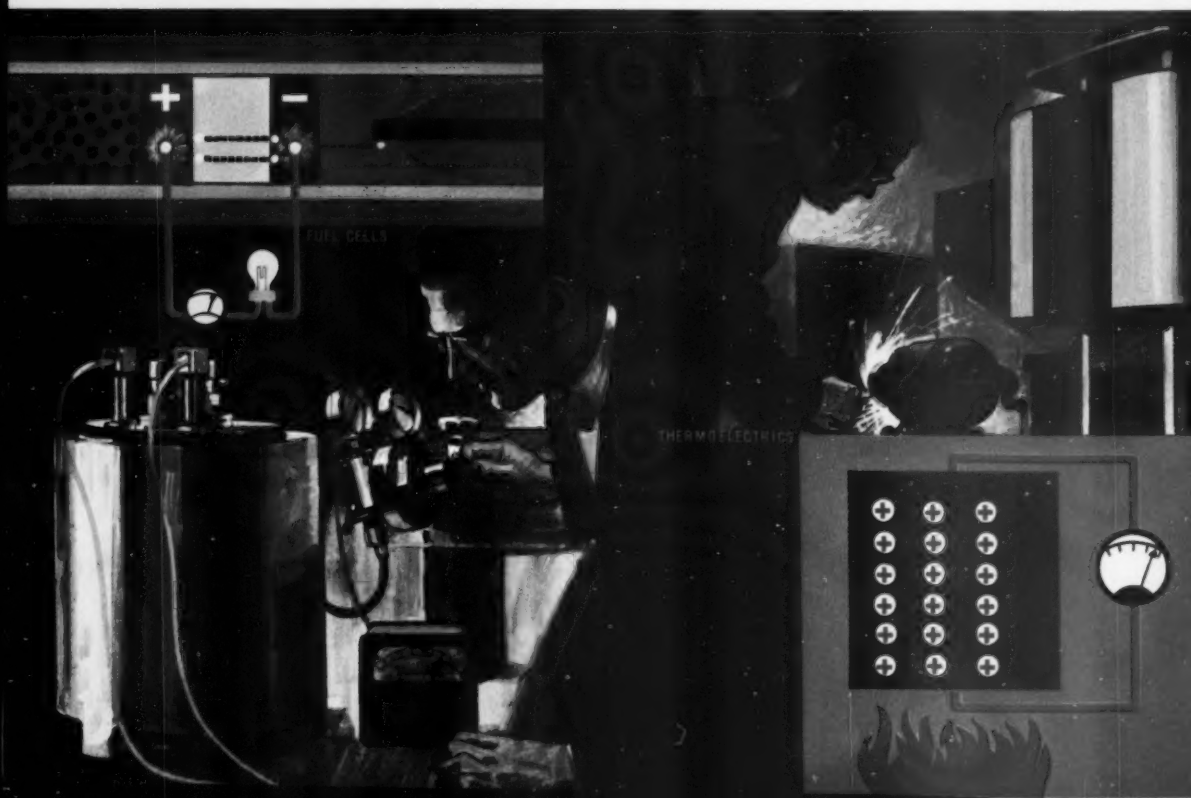
Today, materials do not exist for electrode an trolyte which are at once resistant to high tempe corrosion, are highly conductive, yet low in cost. inghouse is attacking these complex materials lems. Because of this major effort, a new power within 15 to 20 years, may be available to you

Thermoelectric peaking generator predicted for 1970

Practical, economical thermoelectric power is dictable generation opportunity within 20 year

The thermoelectric effect occurs when heat plied to one end of some materials . . . negative c move to the cold side, the positive do not. In materials, the opposite reaction will take place nected in series, these materials form a thermo Electrical efficiency depends upon the ability materials to maintain temperature differential, hand, and substantial electron flow, on the oth

Studies have proved that semiconductors, ha between best insulators and best conductors, most efficient thermoelectric materials. Westin



is currently conducting massive research among the hundreds of thousands of possible semiconductors to "build" optimum materials. To obtain high efficiency, thermoelectric conductors must be operated at high temperatures. In the quest for ideal alloys, the best materials Westinghouse has developed to date are 17% efficient. Based on present knowledge of materials, efficiencies to 30% are expected within 5 years. Breakthroughs to 50% or even higher values are not improbable.

A thermoelectric generator might well be constructed of many thermocouples in series, on a cylinder, for example, and fired by either fossil or atomic fuels. Large-scale devices face problems of corrosion, thermal and electrical insulation, heat and radiation dissipation, mechanical stresses. While problems are in almost fantastic variety, Westinghouse is attacking them all . . . with substantial progress in their solution.

The efficiency of thermoelectric devices is already competitive with small heat engines and is expected to improve rapidly. By 1970, Westinghouse expects to be able to build a 20% efficient, 100-megawatt generator for utility peaking service.

Thermionic topping unit can raise nuclear plant efficiency 55%

The third important Westinghouse development promising economic production of power by static equipment is the thermionic generator.

A thermionic power converter is essentially two conductive plates in an evacuated chamber. As heat is applied to the first plate, electrons are "boiled out" and flow to the second plate. This produces an electric current. The higher the temperature, the higher the efficiency of this generator.

Realization of a competitive thermionic device depends upon materials that can withstand high operating temperatures and maintain a low evaporation rate with high electron emitting capacity.

Looking ahead, Westinghouse sees this generator as a topping unit for a nuclear steam plant, taking advantage of high temperatures available. An atomic plant, at 27% efficiency, plus a thermionic plant, at 20%, offers an over-all efficiency of 42%. Efficiency of the thermionic device itself may theoretically climb to 50 or 60%, may cut up to one mil in fuel costs per kwhr.

10-kw fossil-fueled magnetohydrodynamic generator—largest in the world—foretells 380-mw equipment at 60% efficiency

Magnetohydrodynamics is the concept of generating electric current by forcing a gaseous conductor through a magnetic field.

Heated, ionized gas is passed through a magnetic field. Free electrons flow to an electrode at the top of the field, through a load to another electrode at the bottom of the field, creating a current. An ionized gas, at 4000°F, is used as fuel. Its velocity is between 2000 and 4000 miles per hour through a combustion chamber inside the magnetic field. The gas functions the same as rotating copper through a conventional generator.

Westinghouse is pointing toward magnetohydrodynamic generators ranging above 100 megawatts, using an atomic reactor to heat the gases to perhaps 4200°F. Calculations on a 380-mw design, for example, disclose a possible, practical operating efficiency of 60%, a reduction in fuel costs of possibly 1¼ mils per kwhr. A variation of this large-scale generator might burn fossil fuel, the combustion products passing through the system.

What are the problems presently standing in the way of an economical, commercial-size unit? Temperatures for these systems start at 3500°F. New magnetic and electrode materials must be developed which will maintain structural strength for 20 years above these temperatures. These materials must contain the gases under extreme temperatures at velocities up to 4000 mph . . . without adverse chemical reaction. The problems are impressive . . . but so is the plan to conquer them. A broad and definite program of research and development may one day enable Westinghouse to offer you a completely proved, highly efficient magnetohydrodynamic generator.

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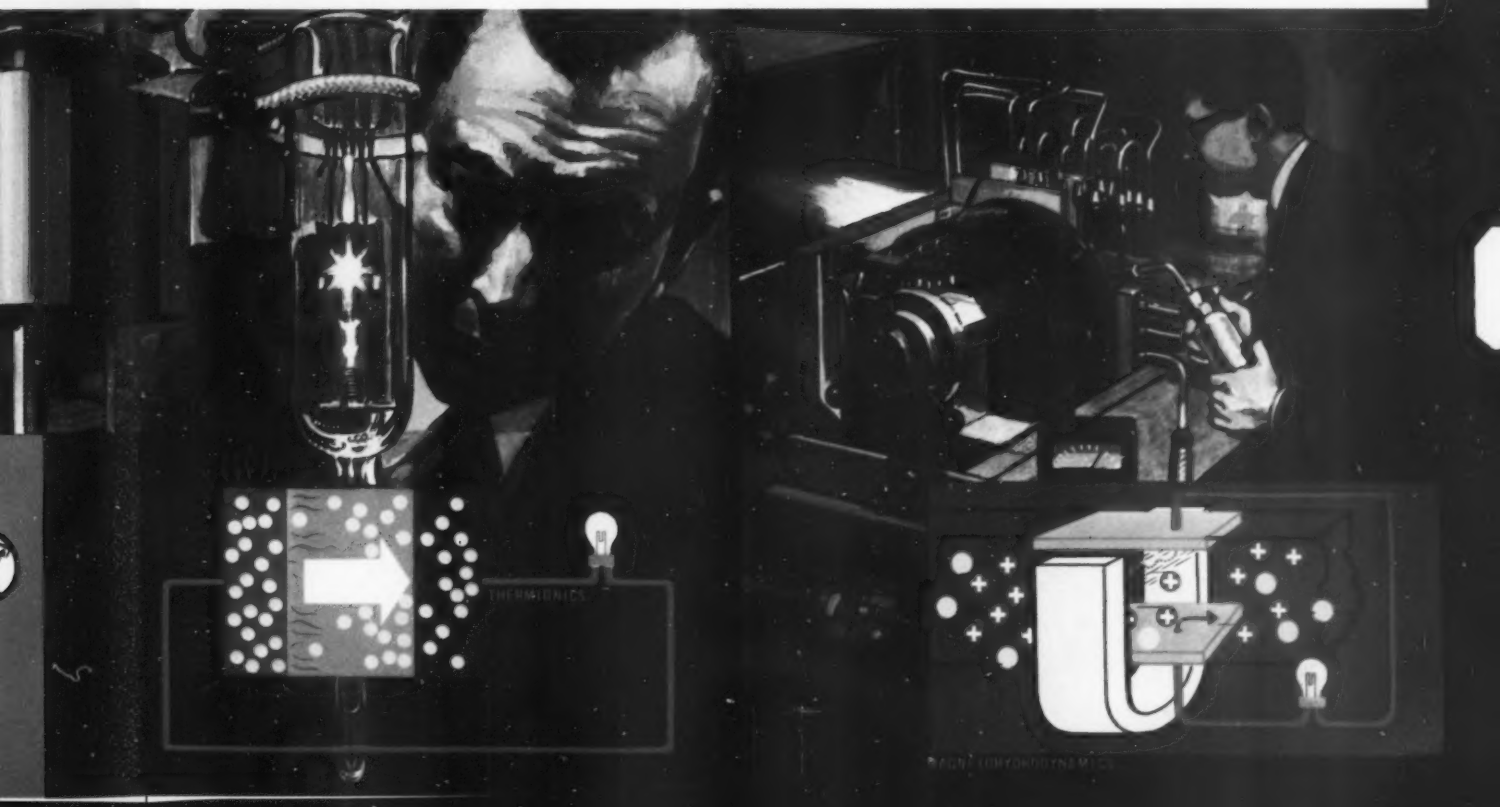


WESTINGHOUSE POWERCASTING* develops new concepts of power system planning, equipment for economical industrial growth

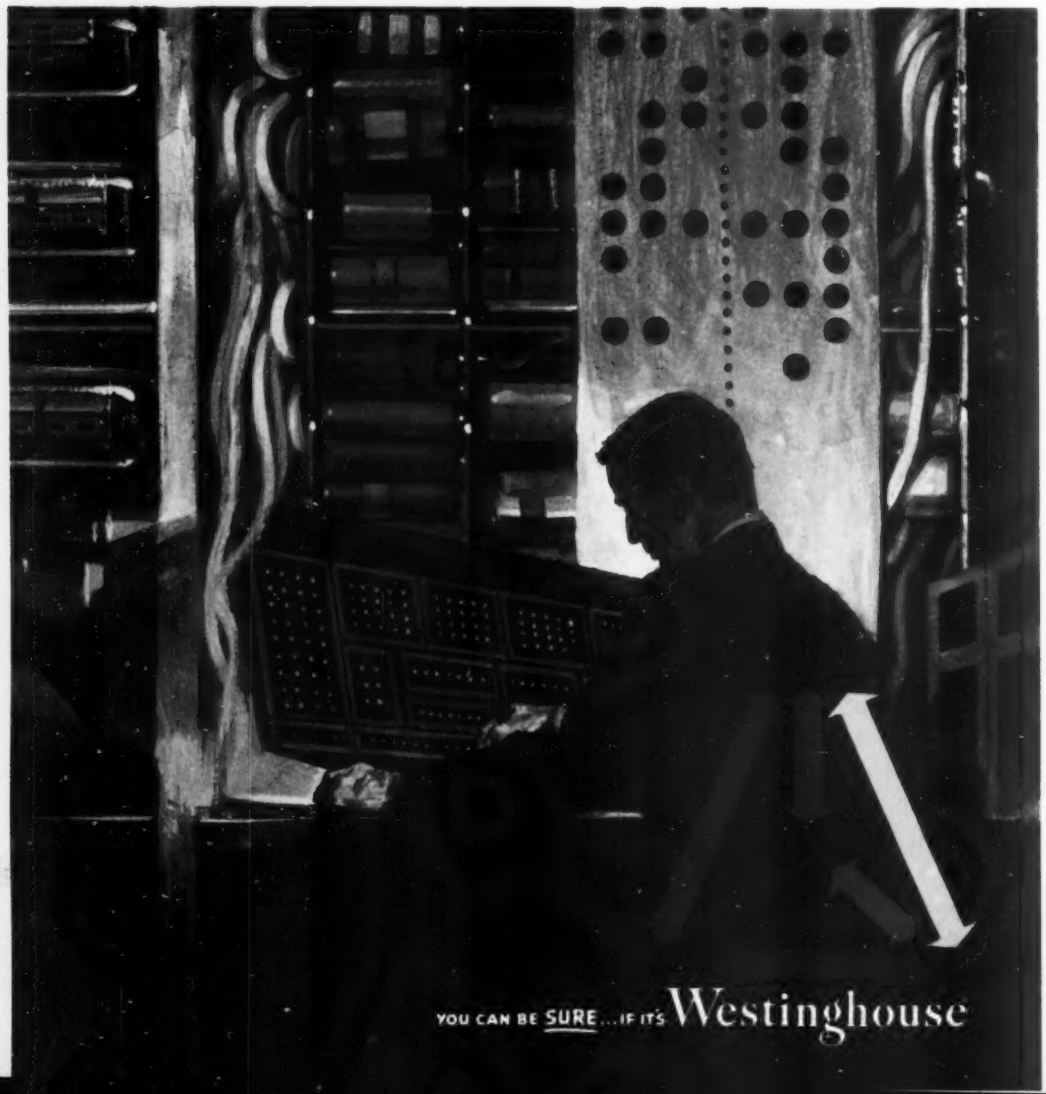
Westinghouse Powercasting is a continuous plan of action devoted to the stable growth of the electric utility industry. Toward this end, Powercasting has created a method of predicting your future system needs accurately. Concurrent with this activity, Westinghouse carries on a program of product development for generation, transmission and distribution, geared to the needs of the industry's future systems.

One area of research receiving intensive attention is direct conversion generation, discussed on these pages. These power sources are potentially more efficient than steam generation—some by a wide margin. Capital costs are potentially lower. Any or all of these plants may one day fill new, cost-saving roles on your system. While foreseeable improvements in the steam plant may cut ½ mil from fuel costs, the fuel cell, for example, may reduce these costs by as much as 1¾ mils. As a base load generator, this device alone could mean per annum savings of hundreds of millions of dollars to the industry.

Concurrent with this broad-based product development, Powercasting is setting up system planning guideposts for the application of revolutionary new equipment. It is the task of Powercasting to be prepared for major breakthroughs . . . to determine which power sources will be most economical, when, in what sizes, and in what type of service on your system. Capital outlays, operating costs, transmission and distribution requirements and new areas of product development must also be analyzed. Altogether, to develop sound concepts of power system expansion and operation, Westinghouse Powercasting searches the entire field of the fundamental sciences for new knowledge, new ideas.

For more information about future power sources, get in touch with your Westinghouse representative.

CP-1057 Litho in U.S.A. *A Service-Mark of Westinghouse



JOSLYN valve arresters are REGISTERED*

*Each arrester, completely assembled, is power follow current tested at 10% above rated voltage. . . . 3, 6, 9, 10, 12, 15, 18 kv . . . with current and arrester serial number REGISTERED. The arrester is passed only if the peak recording ammeter reading is within permissible limits.

Impulse testing alone does not reveal the occasional random characteristics of silicon carbide, which could develop into failure after repeated lightning and follow current discharges in service.

Joslyn tests each arrester for its "circuit breaker" ability, utilizing the greater heat energy of follow current to determine accurately the stability of the silicon carbide.

THREE SIGNIFICANT IMPROVEMENTS JUSTIFY JOSLYN VALVE ARRESTERS

- "Micro-Pack" valve element, a special formulation of silicon carbide grains of controlled resistivity, without cement or binder, gives low discharge voltage and high thermal capacity.
- Simple, FULL CURRENT RANGE quench gap structure . . . . electrostatically shielded to obtain lowest sparkover.
- Hermetic sealing assured by means of confined neoprene gaskets under measured pressure.

SPECIFY JOSLYN VALVE ARRESTERS TO GET REGISTERED PERFORMANCE

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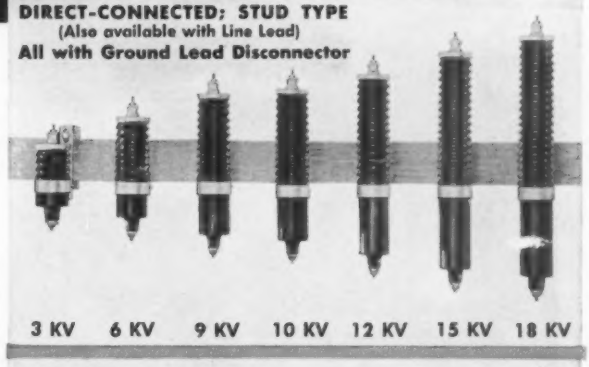
(Also available with Line Lead)
All with Ground Lead Disconnector



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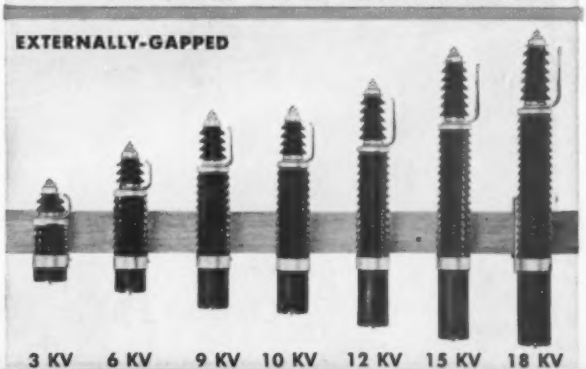

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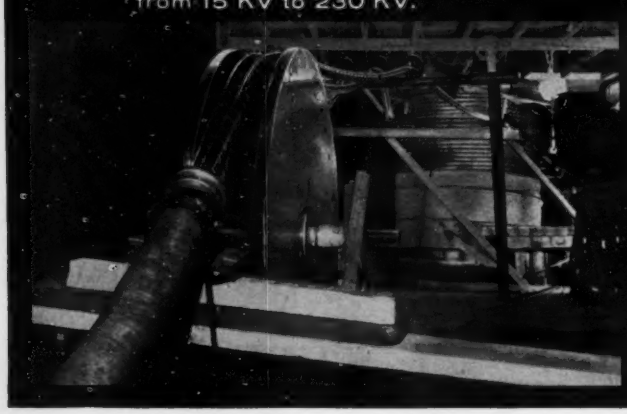

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Only Phelps Dodge has manufacturing experience and operational "know how" with the entire range of high voltage cables which includes: oil compression, gas compression, high pressure oil, high pressure gas, pipe type cables; medium pressure gas, low pressure oil-filled, low pressure gas, submarine and solid type cables.

Low Pressure, Gas-Filled Cable, from 15 KV to 44 KV.

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*Lower voltage cables in this class also available.

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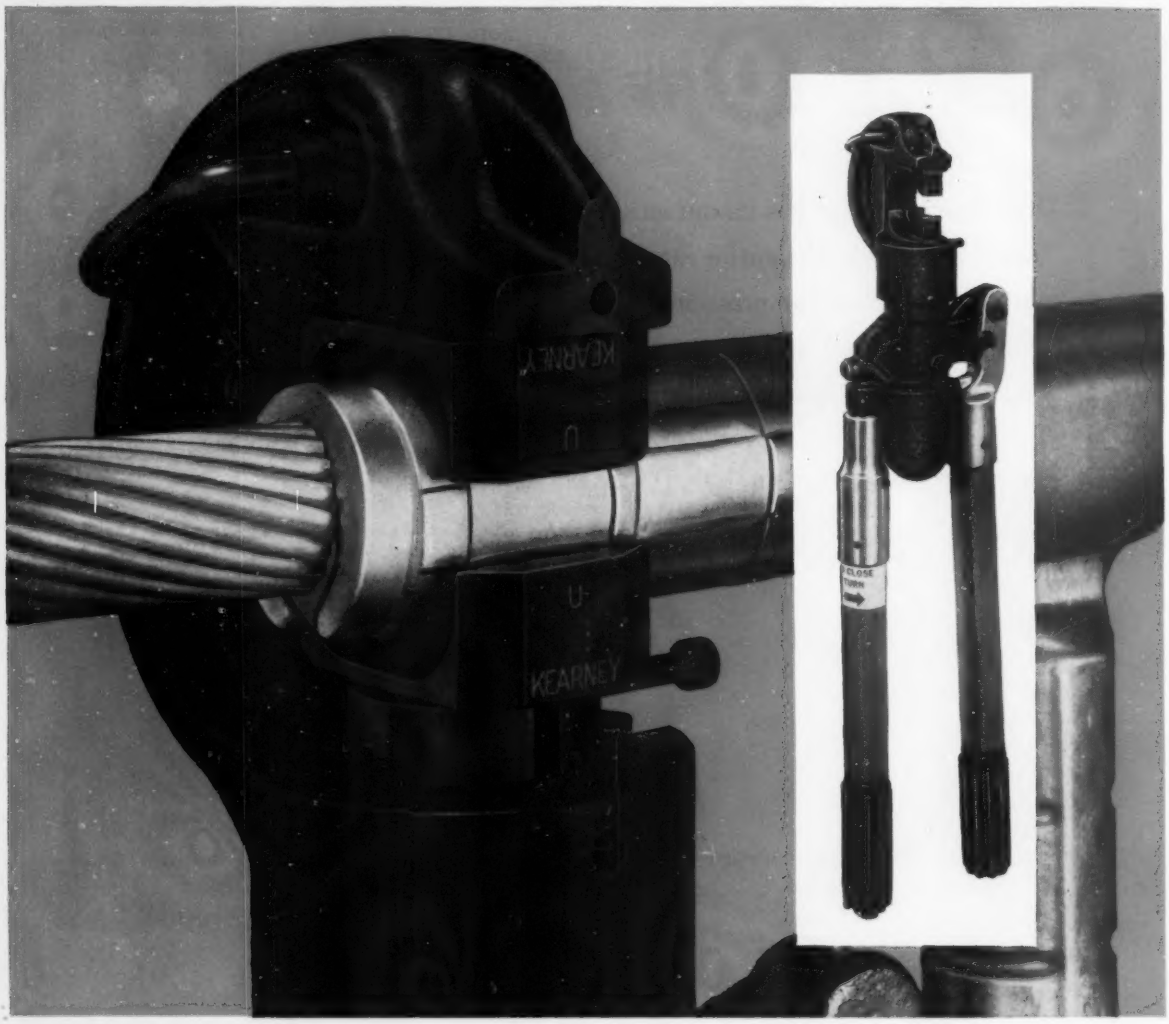
KEARNEY WH-2 HYDRAULIC TOOL AND



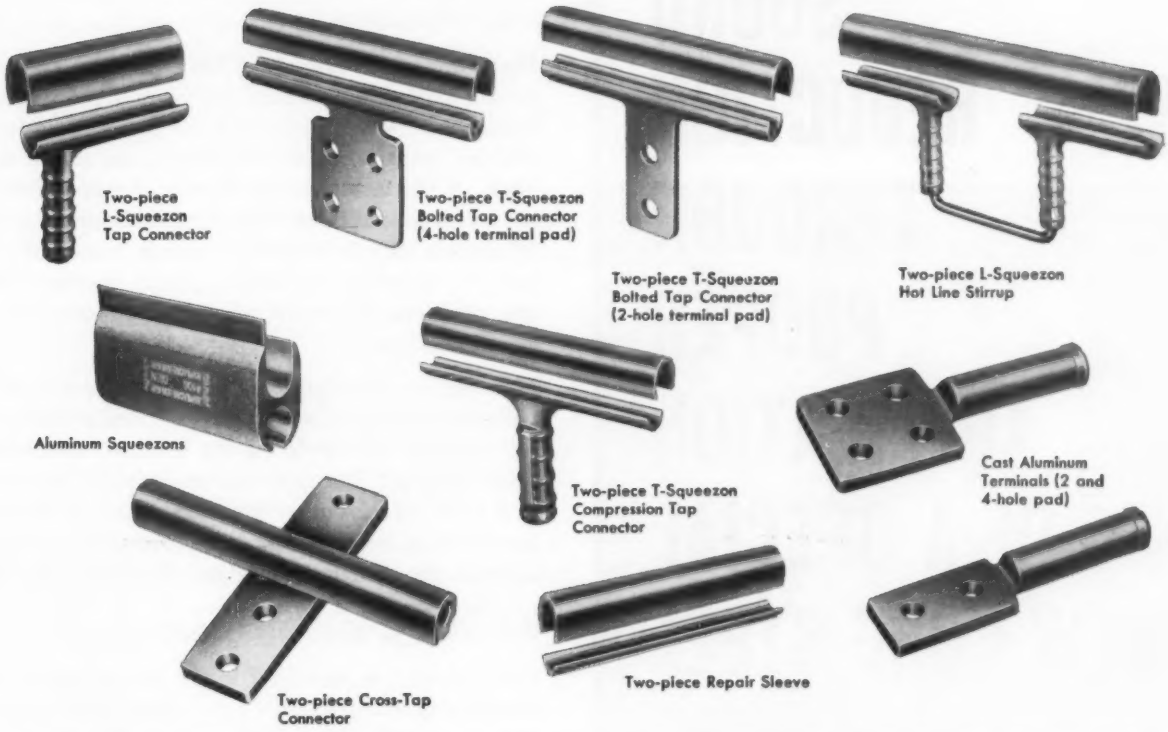
This is the tool... Kearney does it again! The Kearney WH-2 Hydraulic Tool—big brother to the WH-1 Tool—is the FIRST and ONLY portable, hand-operated, hot-line compression tool to accommodate such a wide range of fitting and conductor sizes. Equipped with only this ONE tool linemen can now install tap compression connectors on all sizes of energized and non-energized conductors from #6 Solid through 636 MCM ACSR! Die sizes are the same as those for the Kearney WH-1 Tool, plus the additional sizes required to install the larger fittings shown on the opposite page. Dies snap in or out easily . . . can be secured with a set-screw. A two-step, high speed pump generates full 21,000 pounds of thrust. An automatic overload valve prevents over-compression. Large C-frame head allows clear view of work area while making indents. A partial rotation of one handle sets tool to compress or retract dies—no need to remove either hand from handles. Interchangeable insulated handles are available in various lengths to adapt tool to individual voltage requirements.

For further information, contact your Kearney

PLANTS AT: ST. LOUIS • FAYETTEVILLE, ARKANSAS • SHENANDOAH, IOWA

2-PIECE COMPRESSION CONNECTORS

. . . extend the connection range to include installations on all "Hot" or "Cold" lines from #6 Solid to 636 MCM ACSR


Two-piece L-Squeezon Tap Connector
Two-piece T-Squeezon Bolted Tap Connector (4-hole terminal pad)
Two-piece T-Squeezon Bolted Tap Connector (2-hole terminal pad)
Two-piece L-Squeezon Hot Line Stirrup
Aluminum Squeezons
Two-piece T-Squeezon Compression Tap Connector
Cast Aluminum Terminals (2 and 4-hole pad)
Two-piece Cross-Tap Connector
Two-piece Repair Sleeve

These are the fittings . . . New, larger Kearney tap connectors and the Kearney WH-2 Hydraulic Tool now extend the tap compression connection range to include installations of highest electrical efficiency on energized or non-energized conductors as large as 636 MCM ACSR. Kearney two-piece aluminum tap connectors accommodate large conductor sizes from 266.8 MCM through 636 MCM ACSR. Tap units slide into and interlock with an encircling sleeve unit. Sleeve for any one conductor size will accept interchangeably various tap units of the same size range. Kearney interlock design aids installation . . . insures uniform compression and full-circumference contact . . . eliminates strand cutting. Sufficient connector mass without excess weight assures cool-running connections. Interchangeability of tap units helps reduce storekeeper inventories.

Also illustrated: Kearney Cast Aluminum Terminals, accommodating wire sizes from #2 ACSR to 1000 MCM Str.; Aluminum Squeezons for wire sizes from #6 Solid to 397.5, line or tap.

sales representative . . .

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POWER TRANSFORMER SOUND REDUCTION THROUGH PROPER APPLICATION OF A SPECIAL NEW CORE STEEL

Improved power transformer cores having a marked reduction in the sound energy generated are now available as a result of a basic development program directed at the source of sound as contrasted to the suppression of sound

by

C. M. LOVELL,

Vice-President in Charge of Engineering and Research

Introduction

Many important steps have been taken by the transformer manufacturers in recent years to reduce power transformer sound; but in some areas, the electric utilities' transformer sound problem has continued to grow. A big factor in the growth of this problem is the increased public sensitivity to transformer sound. While this may be absurdly acute in some cases, the fact of a growing and serious public reaction makes the problem of sound of major concern to the electric utilities.

Moloney Electric Company is conducting several developmental programs to obtain practical and economical methods of alleviating the utilities' transformer sound problem. The particular program discussed here is a basic development program aimed at reducing sound levels by attacking the problem at its source through the proper application of a new core steel.

SOURCE OF SOUND

Sound energy is generated in the power transformer core by magnetostriction—a pulsating change in length of the core steel when carrying alternating flux. While some additional sound energy is generated by pulsating attraction forces within the core, this sound can be readily minimized by skillful core design and manufacture.

The sound energy thus generated by magnetostriction in the core is transmitted mechanically to the tank and outer accessories of the transformer—from there to the surrounding area.

APPROACH TO SOUND REDUCTION

There are obviously two main channels of attack on sound—

MOLONEY ELECTRIC COMPANY

Since 1896 . . . MORE POWER TO YOU . . . WITH

(a) Reduction of the amount of sound energy emanated from the transformer by using suppressive means.

(b) Reduction of the amount of sound energy generated at the source—that is, in the core.

A great deal of work has been done by the transformer manufacturers in the development of various means of suppressing sound. In those cases, however, where substantial and consistent reductions are achieved—such as with double tanks—the degree of cost increase is high. Also, the weight, dimensions, and complexity of the transformer are substantially increased. With lesser suppressive means—such as resilient supporting pads—the sound reductions achieved tend to be marginal and inconsistent.

These results indicate that reduction of the sound energy generated at the source is a more positive approach to the problem than the use of suppressive means.

NEW SPECIAL TYPE OF STEEL

In response to a request by the Moloney Electric Company, the Allegheny Ludlum Steel Corporation has developed and made available a special low magnetostriction steel known as "SILECTCOR".

This special steel is stress free, exceptionally flat, and has a remarkably low magnetostriction characteristic. Basic watt loss or permeability remain the same as for conventional cold-rolled oriented steel.

APPLICATION OF THE SPECIAL NEW STEEL

To properly apply SILECTCOR to power transformers on a production line basis it was necessary that new core design and manufacturing techniques be developed. Without these new techniques, the superior qualities of the special steel would not be reflected in improved core performance.

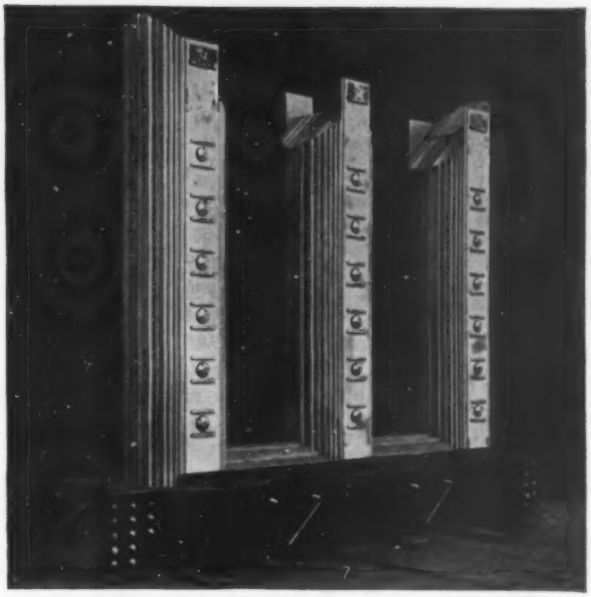
The new core design and manufacturing techniques necessary were developed by Moloney Electric Company after an extended research program to determine the design and production procedures that would result in the lowest sound levels at a reasonable cost.

To date, these new techniques and the special steel have been successfully applied by Moloney Electric Company to approximately 150 power transformers ranging in capacity from 500 KVA to 217,000 KVA. It is planned to steadily increase the application of this new steel to Moloney power transformer production.

RESULTS ACHIEVED

Other factors the same, average reductions of approximately 8 decibels in sound level are consistently attainable as a direct result of the proper application of SILECTCOR to the larger sizes of power transformers. The reductions decrease gradually to approximately 4 decibels for the smaller sizes.

It is significant that these sound level reductions are attainable for a reasonable manufacturing cost increase and without increasing weight, dimensions, or complexity of the transformer.



Cores built with SILECTCOR are remarkably straight as illustrated. This straightness minimizes clamping stress concentration and thus leads to side benefits of reduced core loss and exciting current.

The program is a good example of the positive value to the electric utilities of the constructive research and development being carried on in the manufacturing industry. Moloney Electric Company is conducting continuous research and development programs both in cooperation with customers and suppliers, and independently, to find better answers to the transformation problems facing the industry. ME-60-22

FACTORIES: ST. LOUIS 20, MO. AND TORONTO, ONT., CANADA

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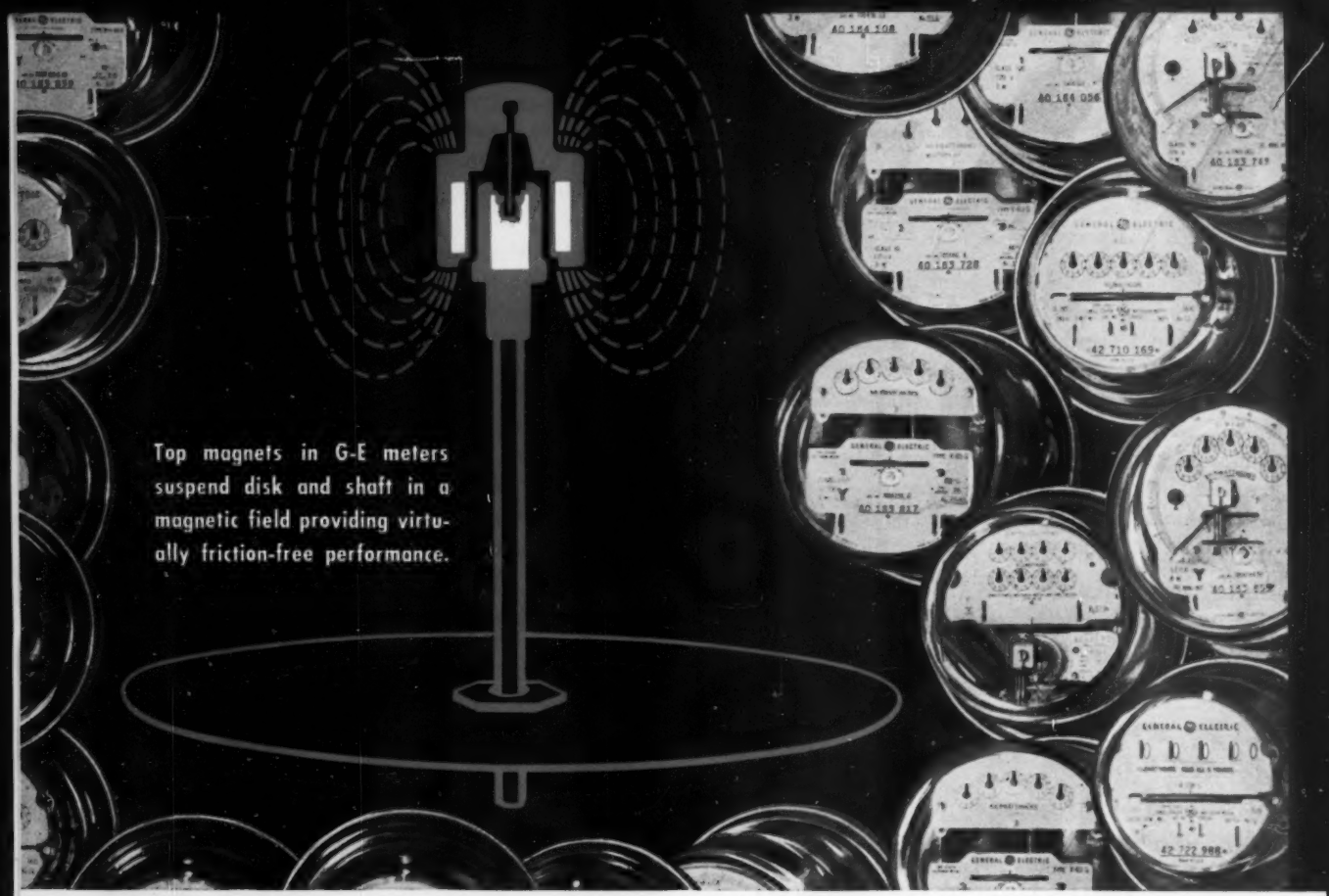

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General Electric Magnetic Suspension Meters Are in Service Without a Single Bearing Failure

Since General Electric introduced the first magnetic meter-bearing system over 12 years ago, nearly 12,000,000 G-E magnetic suspension meters have accurately measured over 200-billion

12,000,000

kilowatthours of electrical energy—without one magnetic suspension system ever having been replaced because of wear. This is reliability, proved by on-the-line performance. **Contact your G-E Sales Engineer for full information or write General Electric Company, Somersworth, N. H.**

713-07

METER DEPARTMENT

GENERAL ELECTRIC

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How many of your employees are still using the plan—every month?"

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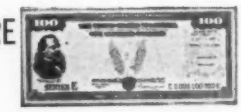
If your company has not installed the Payroll Savings Plan thus far, you, too, may be surprised to find how great a number of your people will welcome this convenient way to start saving. The Plan is simplicity itself to put in. Just contact your State Savings Bonds Director and have him show you just how the Plan works. Let him help you set up a thorough canvass of your company family, so that every employee may be invited to share in this easy way to become a shareholder in America. Experience in other fine companies shows that such an invitation usually results in an enthusiastic response.

ALL U.S. SAVINGS BONDS—OLD OR NEW—EARN ½% MORE THAN BEFORE



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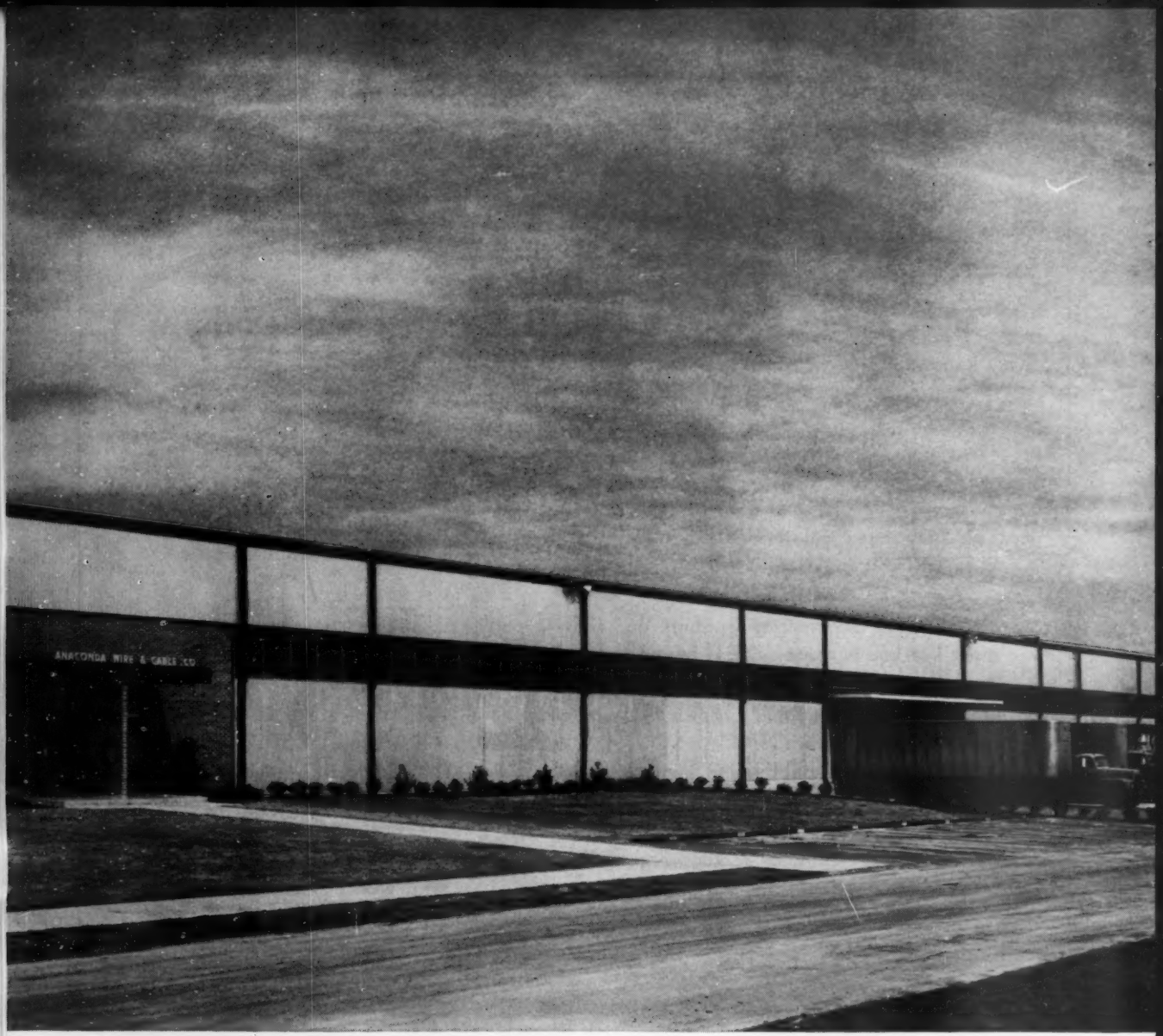

The modern wire and cable plant to serve the dynamic South

We have served the South for many years, and we have been proud to share in this region's unprecedented growth.

Now, this new Anaconda Wire & Cable Company plant will provide the way to even better service – thanks to its modern manufacturing and storage facilities and central location.

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In addition, the complete research and engineering facilities and the varied manufacturing skills of the entire Anaconda Wire & Cable Company are available to – and stand behind – the new Watkinsville plant, an expression of Anaconda's pride to be part of the dynamic South.

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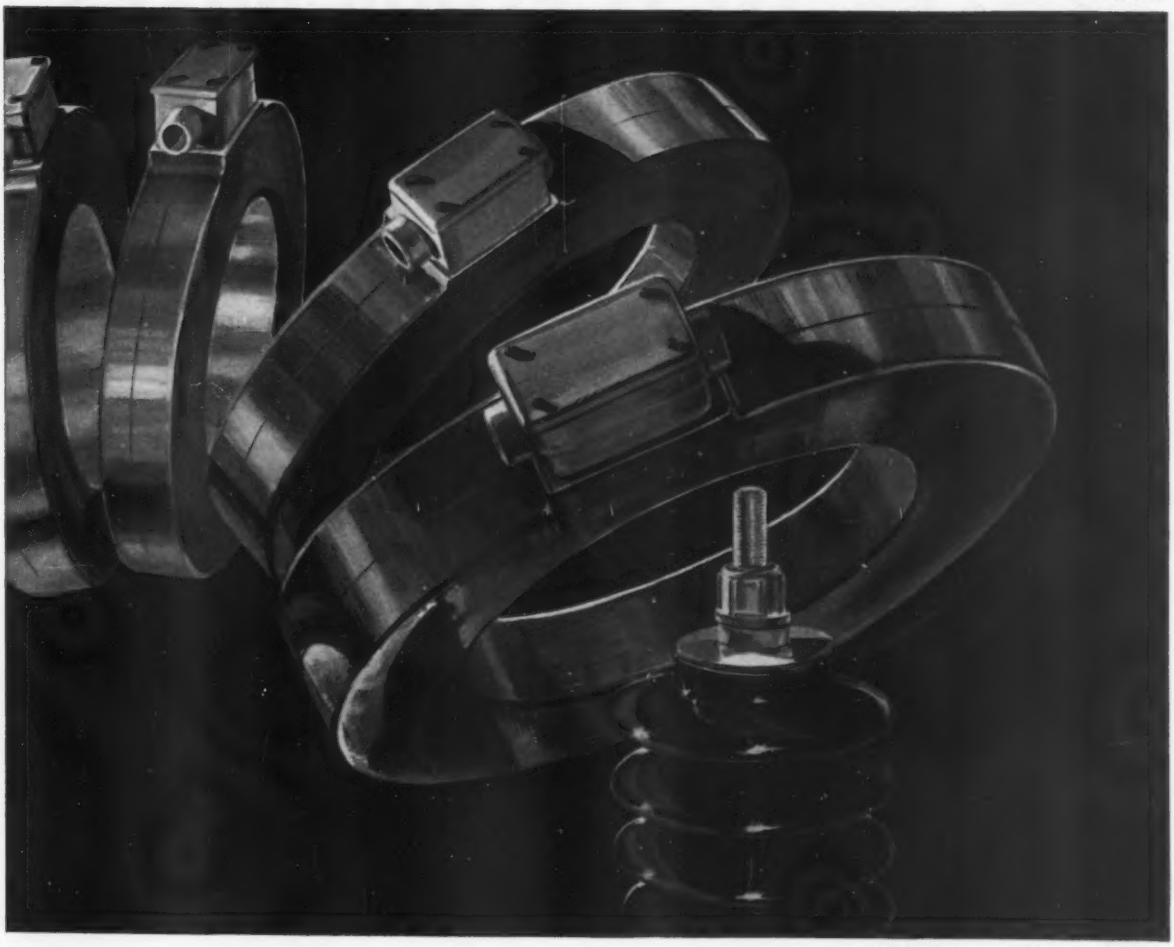

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"PLUS" Larger hand-hole for easier fishing.

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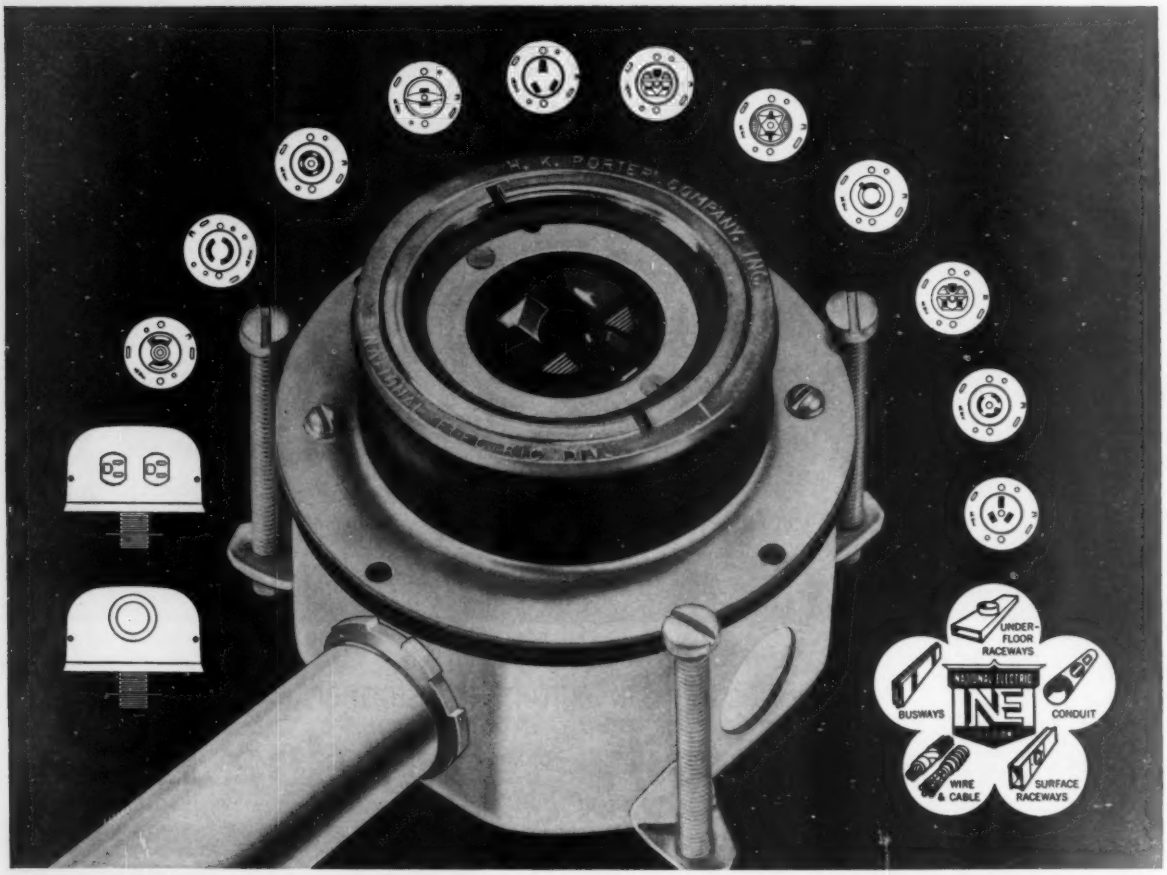

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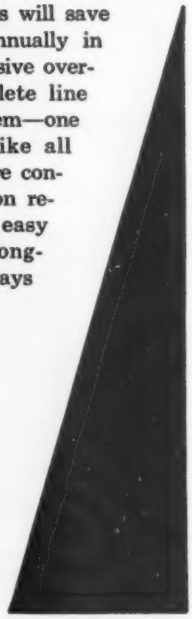

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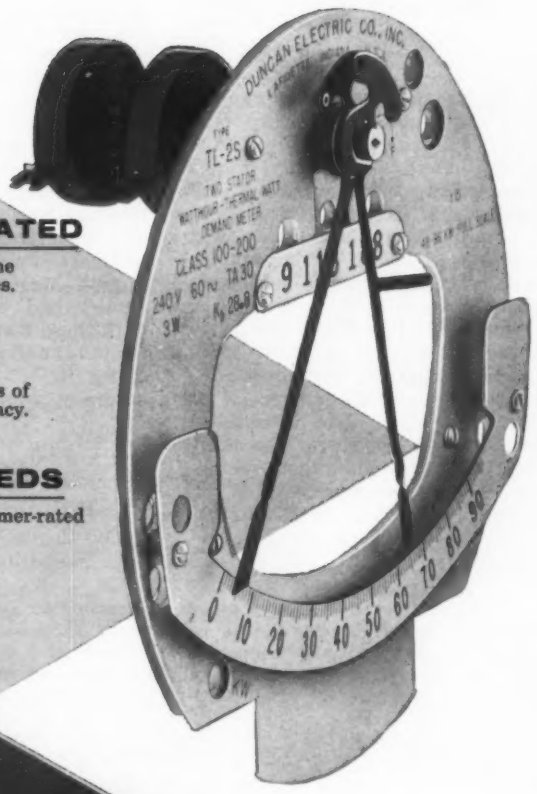
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3 W
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THERMAL METERS

"Thinking Ahead ... Moving Ahead ... to stay Ahead of Demand"

WATTHOUR METERS • MOUNTING DEVICES • DEMAND METERS

Statistical evaluations

By Joseph L. Peterson
Supervisor, Product Evaluation
Meter Department
General Electric Co.

◆ TEN YEARS of workaday experience using the statistical techniques of sample testing have brought General Electric's Meter Department, Somersworth, N. H., handsome dividends in the form of improved product quality and performance, plus dollar savings in reduced maintenance and spoilage.

Since 1950, the Department has employed quality control techniques throughout its manufacturing processes, from the receipt of raw materials right on through to the completed products. In addition, after the individual meters are 100% tested and certified for shipment, the Product Evaluation Unit of the Laboratory selects a continuous random sample and audits accuracy and performance.

Each meter sampled is subjected to a stringent series of tests, and the results are analyzed statistically to give management an unbiased measurement of the current process quality. In the case of the certified single-phase meter lines, this measurement is made with a confidence level of 99%.

Fortunately it is not essential that one be a statistician to generally understand, discuss, and effectively apply statistical techniques. Most of us in the "meter-game" had our first encounter with these methods with the certification announcement of the I-50 meter in 1951. Here, the group accuracy was expressed by two statistics, bar-X ($\overline{X}$), the arithmetic mean, and sigma (σ), the dispersion about the mean.

Historical background

The theory used in such statistical evaluations (or if you prefer, sample testing or selective testing) is not so new as it may first appear and a little study will show the basic mathematics are as much as several centuries old. It was in the 1700's that the probability aspects of the binomial and normal distributions were derived, and in 1837 Poisson made his contribution. Though these probability techniques have been employed for many years in games of chance and in the fields of astronomy, science and agronomy, they remained relatively dormant to industrial applications.

In the 1920's the Bell Telephone Laboratories pioneered some of this work in industry, but it really took World War II to apply the greatest impetus. Certainly, the Federal Government could not 100% test the billions of dollars in weapons, and historically this can be readily understood in the area of explosives. Following the war the Government issued MIL-

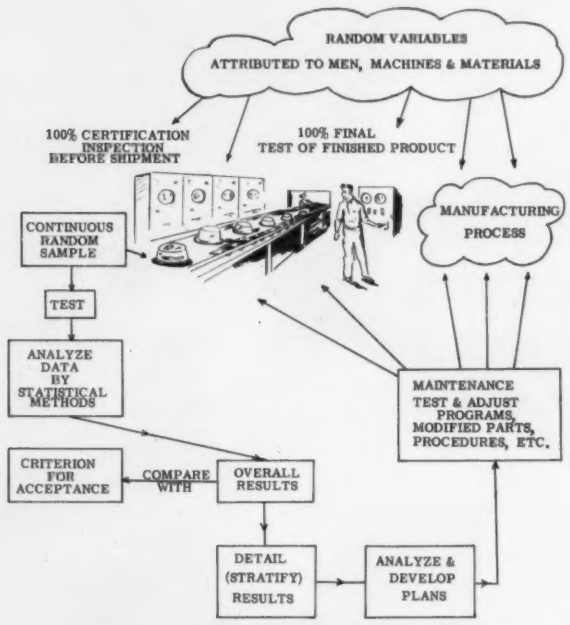


Fig. 1—This diagram illustrates the operation of a sample test program as applied to meter manufacturing. A few modifications would present a practical approach for a utility company's sample testing program. For example, the random variables would be such items as age, wear, corrosion, surges, etc.

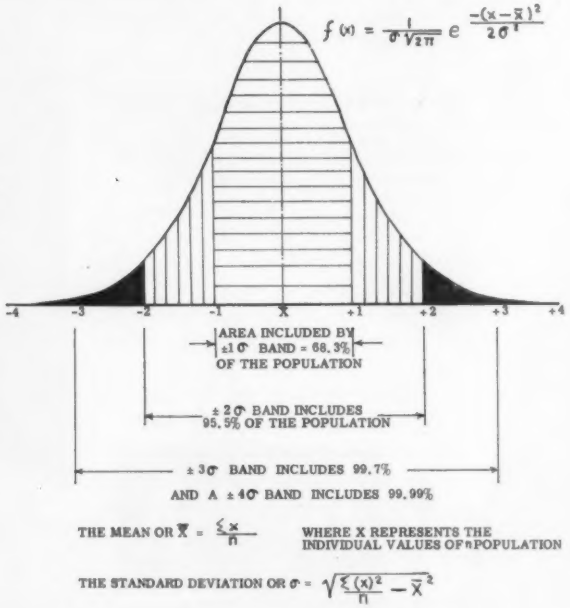

$f(x) = \frac{1}{\sigma\sqrt{2\pi}} e^{\frac{-(x-\bar{x})^2}{2\sigma^2}}$
-4 -3 -2 -1 $\bar{X}$ +1 +2 +3 +4
AREA INCLUDED BY ±1σ BAND = 68.3% OF THE POPULATION
± 2σ BAND INCLUDES 95.5% OF THE POPULATION
± 3σ BAND INCLUDES 99.7%
AND A ± 4σ BAND INCLUDES 99.99%
THE MEAN OR $\bar{X} = \frac{\Sigma x}{n}$ WHERE X REPRESENTS THE INDIVIDUAL VALUES OF n POPULATION
THE STANDARD DEVIATION OR $\sigma = \sqrt{\frac{\Sigma (x)^2}{n} - \bar{X}^2}$

Fig. 2—This is the normal distribution curve—the familiar bell shaped curve associated with variables plans. The mathematical basis for the curve is given in the exponential equation at the upper right corner for "f(x)". From this curve are derived the two principal quantities used in sample analysis: bar-X and sigma.

# of metering accuracy

STDS. 105 and 414 for use by the general public, and these specifications have received wide application in industry.

Perhaps, without the knowledge of statistics, we as human beings have been sample testers since the start of mankind. We use it every day in sampling food and drink before we consume a meal, beverage, lot, universe, or whatever you prefer to call it. If we encounter something unpleasant, we do not have to digest it all before our senses tell us it isn't good. Similarly, when the doctor tests our blood he samples but a few drops; we wouldn't expect or want him to make a 100% check. This is very elementary, but it does point out that if a random sample is selected from a homogeneous group, a true measure of the total population can be obtained.

In a sample testing program for a process such as the manufacture of watthour meters, the random variables attributed to the three "M's" of men, machines and materials are constantly at work within the process as shown in Figure 1. The selecting, testing, and analyzing the results of the continuous random sample gives an over-all measurement of the product quality. By stratifying or detailing results to such things as test stations, specific lots of materials, or even to the people performing an operation, plans are rapidly developed and fed back into the process to correct or improve existing conditions.

Though a utility's sample testing program for determining the condition of meters in the field is not identical with that of a manufacturer, it is similar enough so that a few modifications of Figure 1 would present a practical approach. If the sketch of the manufacturing process were replaced with a map of a utility's geographic area, and if the cloud of impending variables were labeled with the likes of age, wear, corrosion, surges, the similarity becomes quite evident.

So far in describing this general program no mention has been made of such things as sample size and confidence level. Experience

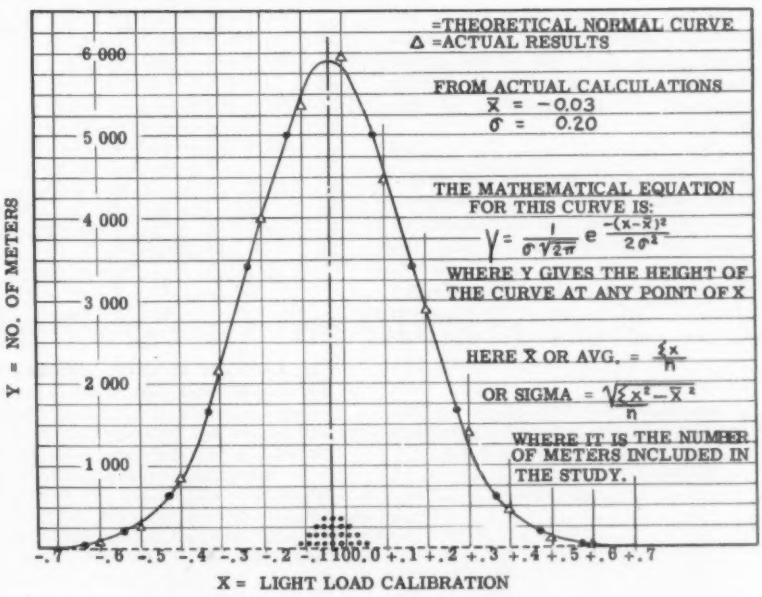

=THEORETICAL NORMAL CURVE
Δ =ACTUAL RESULTS
FROM ACTUAL CALCULATIONS
$\bar{X} = -0.03$
$\sigma = 0.20$
THE MATHEMATICAL EQUATION FOR THIS CURVE IS:
$Y = \frac{1}{\sigma\sqrt{2\pi}} e^{\frac{-(x-\bar{x})^2}{2\sigma^2}}$
WHERE Y GIVES THE HEIGHT OF THE CURVE AT ANY POINT OF X
HERE $\bar{X}$ OR AVG. = $\frac{\Sigma x}{n}$
OR SIGMA = $\sqrt{\frac{\Sigma x^2}{n} - \bar{X}^2}$
WHERE IT IS THE NUMBER OF METERS INCLUDED IN THE STUDY.
6 000
5 000
4 000
3 000
2 000
1 000
Y = NO. OF METERS
-.7 -.6 -.5 -.4 -.3 -.2 -.1 100.0 +.1 +.2 +.3 +.4 +.5 +.6 +.7
X = LIGHT LOAD CALIBRATION

Fig. 3—This diagram illustrates first how the watthour meter accuracy data fits the theoretical normal curve. The large black dots are plotted to show the normal curve; the triangles show the watthour meter accuracy data. As an experiment, the 29,713 meters plotted were considered to be a "universe" and 25 samples of 50 meters each were randomly selected and the bar-X and sigma were computed for each sample. The 25 bar-X's calculated are plotted above (small black dots at lower center). It can be seen that they form the expected normal pattern and each sample of 50 meters accurately predicted the known average or bar-X of —0.03. The bar-X and sigma for this distribution are bar-X sub bar-X, or double bar-X, which equals —0.03, and sigma sub bar-X which equals 0.03. By equation, for a sample size of n, the standard error of the mean is $\sigma/\sqrt{n}$, and the standard error of the standard deviation is $\sigma/\sqrt{2n}$. In our experiment, $\sigma/\sqrt{n} = 0.20/\sqrt{50} = 0.028$, and $\sigma/\sqrt{2n} = 0.20 /\sqrt{100} = 0.020$.

shows there is no "cure-all" statistical plan or program that will satisfy all users and their varied conditions and procedures. Once all of the facets of the plan are established and included in its design, an existing plan from the many texts and tables available can usually be found to conform quite nicely.

In designing a plan, a number of questions must be answered, and generally when they have been, the plan is fairly well firmed up:

(1) How is the data to be used? Do we merely want an over-all result or do we want detail results too? If so, into what categories will we stratify?

(2) What are the criteria for judgment? What is considered good or acceptable? In the case of meter accuracy, if 96% of the universe is within ±2% is this satisfactory or adequate? Shall performance be measured by full load, weighed average, all loads?

(3) What confidence level is needed? Do we want to be 85%, 90%, 95% sure of the accuracy of the sample results?

(4) What statistical method will be used? Variables or attributes; single, double, multiple or sequential sampling? This will be discussed in more detail later.

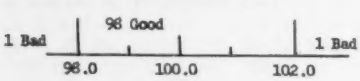
(5) How many units should be tested? This is determined or fixed by our answers to the earlier questions.

(6) How are samples selected? Of course, all theory is based on a random sample, and this must be

absolutely adhered to for sound predictions. Each meter in the universe sampled must have an equal opportunity of being selected. An example of this is the inability of a housewife to select a good basket of strawberries. Invariably she scans the top layer and may even peek at a few of the second layer berries, but more often than not, the small green berries we eat were those tightly grouped at the bottom of the basket.

(7) How are samples tested? Equipments of the highest accuracy and precision are desired, and in addition the manufacturer requires immediate results for feed-back and controls to be effective. The utility has similar decisions as to what equipments to use and whether to field or shop test. Since fewer meters are to be tested in the sample program, it is advantageous to use the best equipments, conditions, and personnel which increase the reliability of the data.

The two basic statistical methods from which sampling plans are derived are called attributes and variables. Both methods are used extensively by industry, and throughout our manufacturing process both are used in quality control procedures. There are many fine texts covering the theory, uses, and advantages of each method, so only a few brief remarks will be made here.



ACCURACY OF 100 METERS

ATTRIBUTE METHOD

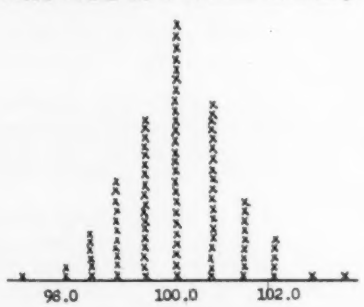
An *attribute* plan is one in which the unit measured is judged to be either good or bad; go or no-go; OK or defective.

Attribute plans are effective where: large samples are practical, units can be easily and rapidly checked, per cent defective is quite large, no great skill or complex testing required, and does not require calculations.

In the *variables* plan, each unit is represented by a measured value, such as reporting the full-load accuracy of a meter as 100.2% rather than just saying by the attribute method that the accuracy is OK. In the variables plan, the prediction is made from the distribution of the individual measurements of the sample; all of the actual data are used, and the prediction is related to where the "tails" of the distribution extend with regard to established limits.

Variables plans are effective where: small samples are desired such as for a destructive test, the unit cost of testing is high, the expected per cent defective is low, and control charts are desired as in a manufacturing process.

In addition, the variables method presents no problem on borderline accuracy measurements; for instance, if a meter is 97.9% and the acceptable limit is 98.0%, there could be a human tendency by attributes to accept it, and similarly a 98.0% value could be rejected. Under the variables method, whether the value is 97.9 or 98.1 has but little significance with respect to the final prediction.



ACCURACY OF 100 METERS

VARIABLES METHOD

On the other hand, the variables plan requires that the population being sampled have a relatively normal or bell-shaped distribution. Figure 2 shows this normal curve and the significance of bar-X and sigma. As shown, relatively simple computations are required to determine bar-X, or the mean, and sigma, the standard deviation. Knowing these two numbers with a normal distribution, the per cent beyond any established limits can be readily predicted. Watthour meter accuracies are affected by random variables, and a plot of their distribution is relatively normal. Figure 3 shows a plot of 29,713 I-55 meters randomly sampled, and as can be seen, their distribution is very normal. Field data on both larger and smaller quantities show similar distributions.

(Continued on page 135)

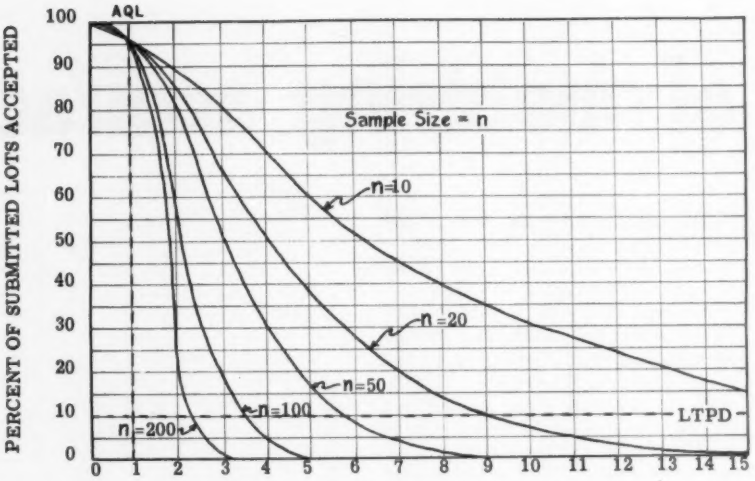
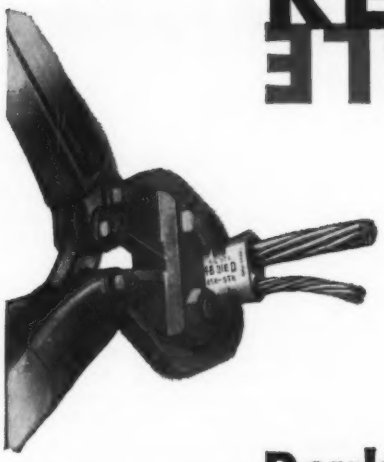


Fig. 4—Every sampling plan has an "OC", or operating characteristic curve, which describes just what the plan will do for you. Since there can be an infinite number of sampling plans, correspondingly, there can be an infinite number of OC curves. Here is a family of OC curves showing the effect of increasing sample size. The plans are single sample-variables for a 1.0% AQL (acceptable quality level). If you examine the OC curve for n=200, lots submitted that are 1% defective will be accepted 95% of the time. Lots submitted that are 2.3% defective will be accepted only 10% of the time, or will be rejected 90% of the time. The LTPD or "lot tolerance per cent defective" is generally shown at 10%. Now compare the OC curve for n=20. The AQL is still 1% but this plan will accept lots 9% defective, 10% of the time. As can be seen, when the sample size or n increases, the plan becomes more discriminatory and approaches the perfect plan of a vertical straight line. Very little accuracy is gained in variables plans by increasing n over 200.

REVERSIBLE



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Cluster mounting for metering

By C. B. Rountree
Power Contract Analyst
City of Austin Electric Dept.
Austin, Texas

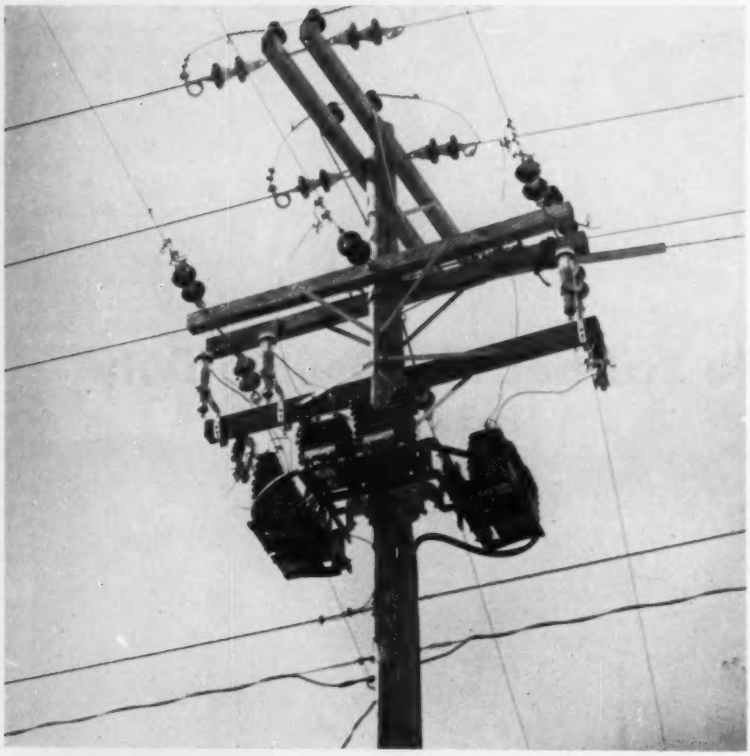


Fig. 3—The completed installation serves a 1,000 kw customer.

◆ THE PRACTICE of building and erecting high voltage meter equipment involves varied requirements that come under the headings of standards, safety, accuracy, adequacy, and the ever present factor, economy.

Planning being the initial stage of any job, it is first necessary to familiarize personnel with the steps needed to meet the requirements set forth above. Ordinarily the working plans to follow consist of specification drawings showing drilling dimensions of cross arms and pole for the mounting of line hardware, the placing of cross arms on pole for locating and hanging current and potential transformers with their accompanying buss work so arranged to permit safety of operation and working clearance where hot line maintenance is involved.

Now that we have our planning stage behind us, we are confronted by the task of gathering our material for the job. Since we know there will be conduit work to do, there will be a necessity of pipe threading tools, a pipe vice and pipe wrenches, as well as numerous pipe fittings. Any extra trips back to the storeroom for forgotten material are not in the best interest of economy, therefore we double check to see that our supply of necessary items is adequate.

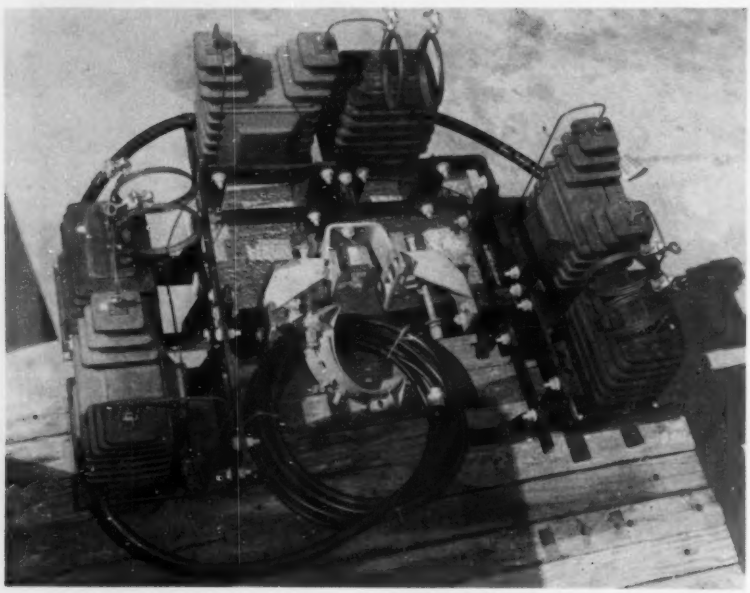


Fig. 2—Here a cluster mount with high voltage metering equipment has been assembled in the meter shop complete with secondary cable connected and flexible conduit attached, ready for pole mounting.

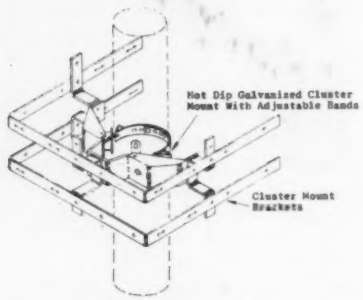


Fig. 1—Cluster mount bracket designed for mounting high voltage metering transformers on poles.

equipment

If we do not have personnel in our department experienced enough to do a fair amount of line work, it is imperative that we arrange with our company's general line foreman for a loan of one or two of his linemen.

If our job has been properly planned, the next eight working hours will be consumed in carrying out these plans. This long accepted method of installation is time consuming and therefore expensive.

Alfred Tramp, Meter Department superintendent of the City of Austin, and Hilton Norwood, shop foreman, decided that there should be an easier, safer and more economical method of mounting high voltage meter equipment. In contrast to the above described manner of mounting such equipment, they have taken a cue from the well known distribution transformer and capacitor mounting and developed a cluster mount for high voltage metering equipment.

First they built a cluster mount bracket, taking into account drilling dimensions to accomodate the mounting of instrument transformers of different manufacture (See Fig. 1).

On each of the three sides of the mounting bracket there were placed one current and one potential transformer. Weatherproof, flexible conduit was used between the secondary conduit boxes. After completion of the conduit run between all transformers, secondary wiring was pulled through and connections made at each transformer. For connections between transformers and meters, the same type of flexible conduit was used, in which the meter cable was pulled. The correct length of this conduit was pre-determined so that a sufficient amount would be in place on the assembly, leaving only the necessity of the meterman on the ground to make the conduit connections to the meter box and cable connections to the meter test switch.

From this we can see that our high voltage metering equipment has been completely shop assembled (See Fig. 2). It can then

(Continued on page 134)

Why not hermetically-sealed single-phase watthour meters?

By W. H. Farrington
Staff Meter Engineer
Texas Electric Service Co.
Fort Worth, Texas

◆ GREATER DEVELOPMENTS and improvements have been made in single-phase watthour meters in the past twelve to fifteen years than in all previous years.

A few of these developments and improvements are as follows:

(1) The capacity of the meter has been extended.

(2) The bearing system has been improved.

(3) There are fewer screw or bolt type connections to give trouble.

(4) The meter is more corrosion-resistant.

(5) They have better insulation as a protection against breakdown.

(6) Magnets have been improved.

(7) Gearing has less friction for longer periods of time.

(8) The meter holds its calibration within acceptable limits for indefinite periods of time.

(9) They are received from the manufacturer in such condition that they can be accepted without test.

All of the above items, and more that are not mentioned, have made it possible to extend test periods far beyond what was thought possible twelve or fifteen years ago. Now, the trend is toward sample meter testing which, in a great many meter engineer's opinion, will be the generally accepted test method within a few years.

In order to further improve the meter, they could be so designed that dust, moisture, insects, etc., could not collect in the meter. The cover should be manufactured from material that would retain the advantages of glass but would practically eliminate breakage.

This could be accomplished by the use of a hermetically-sealed, completely molded base including the present cover, with the exception that a heavy, protected glass or plastic material would be included for reading purposes.

The question may well be asked at this time—How will minor repairs and adjustments be made? The answer is—it is not intended that they will be made, because it is believed that they will be practically eliminated by more improvements that could be expected to be possible with the use of a hermetically-sealed meter.

A survey on our system for one year of all troubles reported on single-phase meters, revealed that only four per cent were of a major nature. Practically all of the 96 per cent of minor troubles could have been eliminated by an improved hermetically - sealed watthour meter.

Since minor repairs and adjustments will not be made, some of these improvements could be:

(1) Elimination of all screws and bolts that could possibly cause trouble.

(2) No adjustments for calibration would be provided, or needed.

(3) All screws and adjustments for bearings would be eliminated.

(4) Stators, magnets, frame, register, etc., would be welded, riveted or molded.

(5) All replaceable gaskets would be eliminated.

These and many more improvements which would be thought of in designing such a meter would, for all practical purposes, eliminate the necessity for making minor repairs, which is the reason in the great majority of instances for having to test the meter.

There would be some major troubles, such as damage by lightning, damage by falling, or being hit by something. These meters would be retired without an attempt to repair. For these types of major repairs, it is generally found now that they cannot be repaired economically.

I believe that a properly designed hermetically-sealed meter of the type proposed would be practical, because the elimination of the necessity for making minor repairs and adjustments, replacing gaskets, replacing glass covers, washing cover, etc., would more than compensate for the small per cent of meters retired because of major troubles.

New meters make debut with

Sangamo

By Edward W. Schwarz

Asst. Engineering Manager
Sangamo Electric Co.
Springfield, Ill.

◆ A MAGNETIC flotation system, which replaced the ball and jewel bearing, is one of the major design changes incorporated in Sangamo's new J3 single-phase watthour meter. Now in full scale production, the J3 meter also includes a new damping magnet system utilizing two pairs of damping magnets located in the sides of a new frame.

Other important improvements were carried out to give the J3 additional operating advantages: epoxy coated current coils, new cover ring and gasket principle, and reduced height.

Throughout all stages of J3 research and development, the main engineering objectives were principally concerned with the criteria that affect sustained accuracy of watthour meters. The basic reasoning for the emphasis on a new watthour meter with better sustained accuracy characteristics was the continuing industry trend toward sample testing of single-phase meters.

All of the design changes were accomplished without sacrificing the proved and accepted features of sectionalized construction, low starting watts and low losses, controllable endshake, and interchangeability.

The floating system of the J3 consists of two cylindrical Alnico magnets located below the disk. One of the magnets is die-cast to the spindle directly below the disk. The other is staked into an aluminum housing which, in turn, is positioned in the die-cast frame. The magnets are positioned so that the north pole of the upper floating magnet faces downward, while the north pole of the lower magnet faces upward. The magnetic field created by the two magnets floats the disk and spindle assembly. The alignment of the flotation system is simplified by use of only two magnetic components compared to designs requiring three or more.

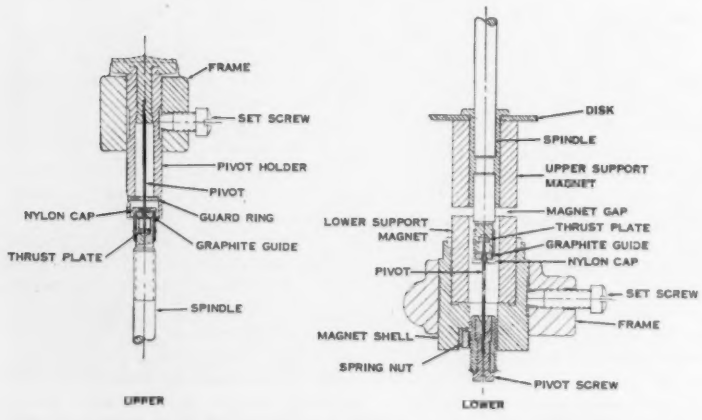
The flotation magnets are manufactured by Sangamo. High coercive force (1000-1100 oersteds) non-directional Alnico is crushed to a fine powder, blended with epoxy, and then molded to form the identical upper and lower cylindrical magnets. By virtue of the closely controlled manufacturing process, the magnets are extremely uniform, both mechanically and magnetically.

Another of the design considerations in developing the magnetic floating system of the J3 was to provide a large air gap between the two magnets. The air gap is held at 0.06 inch which insures adequate mechanical clearance. In addition, this large air gap is clearly visible so that a quick inspection is possible. By utilizing opposing magnetic fields instead of magnetic fields that attract, the Sangamo design further insures that the gap will remain clean indefinitely. Any magnetic particles would tend to be repelled out of the gap—hence, could not bridge the two magnets and create a possible source of erratic light load registration.

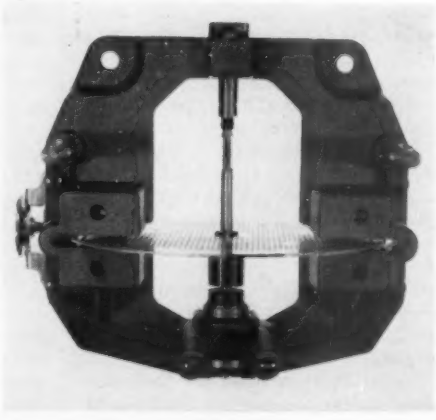
One of the major reasons for using Alnico material for the flotation magnets is its very low temperature coefficient. This low temperature coefficient implies small flux density variations, resulting in negligible disk movement from the center of the damping magnet gap over an extremely wide ambient temperature range. This, plus a new Class 1 temperature compensation, provides an excellent temperature registration curve.

Throughout the development stage, and thereafter, exhaustive tests were conducted to determine surge resistance of the magnetic support system. Surge tests of 20,000 amperes through the neutral wire and 2,000 amperes through the current coil (as prescribed by MSJ-10) fail to affect the charac-

(Continued on page 133)



Details of the Sangamo J3 meter disk floating system are shown here. A feature of the design is the visibility of the magnet gap.



Here the moving system is in position in the frame, as viewed from the front.

magnetic repulsion bearings

Westinghouse

By Thomas D. Barnes
Manager Meter Engineering
Westinghouse Meter Plant
Raleigh, N.C.

◆ WITH THE DEVELOPMENT of the new magnetic material, barium ferrite, the means became available for a design of magnetic bearing that would match the stringent requirements peculiar to watt-hour meters, Figure 1. This new material has exceptionally high stability resulting from its remarkable coercive force of around 1800 oersteds, or some two to three times that of the high energy alnico materials. It is the only known material that requires no normalizing to provide magnetic stability and thus can be used at maximum residual induction for most applications.

As shown by Curve A in Figure 2, barium ferrite essentially has no minor hysteresis loop, as the residual induction (Br) remains virtually constant even after being completely demagnetized temporarily with a coercive force equivalent to its inherent H_c value of 1800 oersteds. The solid line indicates the original induction curve, the dotted line that of the flux return after the 1800 oersted demagnetization.

The exceptional stability of barium ferrite magnets is evidenced by the fact that magnetic fields of 20,000 ampere-turns-per-inch are required for magnetization. All other magnetic materials such as the alnicos of Curve C, etc., require an initial weakening or normalizing to provide minor hysteresis loops (Curves C_1 and C_2) for full reversibility. Complementing these properties, barium ferrite, as a ceramic magnet, also has very high resistivity and low density which makes it particularly adaptable to rotating systems such as are used in watt-hour meters.

The Westinghouse magnetic bearing employs two small, ring-shaped magnets of barium ferrite mounted in steel flux return cups and magnetized to oppose each

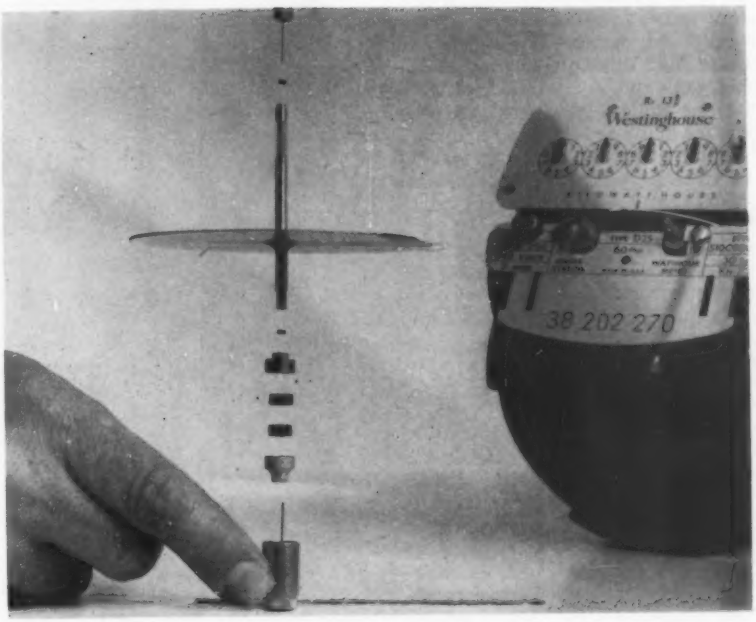


Fig. 1—Exploded view of components that make up disk and bearing system of the D2 meter. In the background is a D2S Class 200 meter.

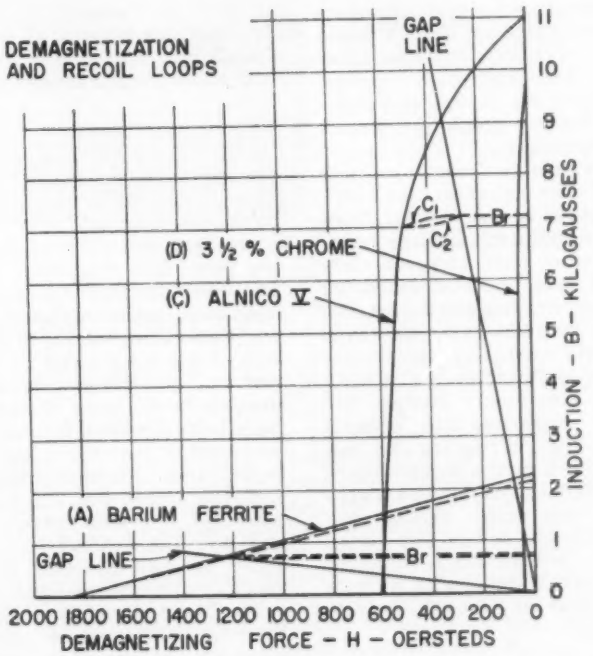


Fig. 2—A desirable feature of barium ferrite is that it has essentially no minor hysteresis loop, and residual induction, Br, remains virtually constant even after being completely demagnetized temporarily with a coercive force equal to its inherent Hc value.

other. One of these is mounted in the lower bearing mount, the other on the bottom of the rotor shaft, as shown schematically in Figure 3.

The magnets are die cast integrally in precision machined steel cups which are assembled to close tolerances for maximum concentricity and uniformity. When assembled, magnetic efficiency is quite high due to the small working gaps and negligible flux leakage as indicated schematically in Figure 3, lower left.

This accounts in part for the vertical support "stiffness" of the system, and also for its independence from external fields, a condition that can be readily verified by noting the absence of magnetic attraction on any iron or steel piece held adjacent to the bearing system. Magnet separation is approximately .020 inch.

Independence of fields

Partly because of the distance of the magnetic bearing from the glass cover but primarily because of its extreme inherent stability, the Magnethrust bearing cannot be demagnetized by strong surge fields or by tampering with magnets. In fact, the high-energy alnico magnets used for damping would be weakened before those of the bearing system.

As illustrated in Figure 3, guide bearings to restrain driving torque side-thrusts are used at both ends of the rotor system. Each of these consists of highly polished and flexible 0.019-inch-high chrome steel pins in the mounts and high-purity bearing-graphite journals in the rotor shaft.

The system has been designed for minimum vibration and bearing pressures to assure quiet operation and maintenance-free bearing life of at least 30 years. Calculations and various extensive tests have demonstrated that the bearings operate quite conservatively with maximum side-thrust pressures well below the recommended maximum loading for graphite. Pressures are only 3 grams at the top bearing and less than 7 grams at the bottom bearing at maximum meter load. Typical life tests under various environments and severe test cycles yield over 100 million revolutions at maximum torques with no discernible wear on either the graphites or pins.

Ruggedness of bearing

The Westinghouse magnetic bearing is designed to meet extreme shock conditions of far more severity than encountered in shipping and handling. Clearances have been designed to prevent any permanent deflection of the bearing pins. Also the lower bearing has been designed for controlled clearances between the lower pin and the bearing cavity in the bottom of the rotor shaft to prevent vertical impacting between the magnet units, even though tests have indicated that this would not be harmful. Because of this built-in clearance, it is impossible to adjust the lower bearing with insufficient clearance between rotor and pin. The bearing is also immune to any practical thermal shock or atmospheric condition.

The Magnethrust bearing is inherently unaffected by any accumulation of possible magnetic particles inasmuch as they would be oriented flat against the magnet faces and thus have no affect on performance.

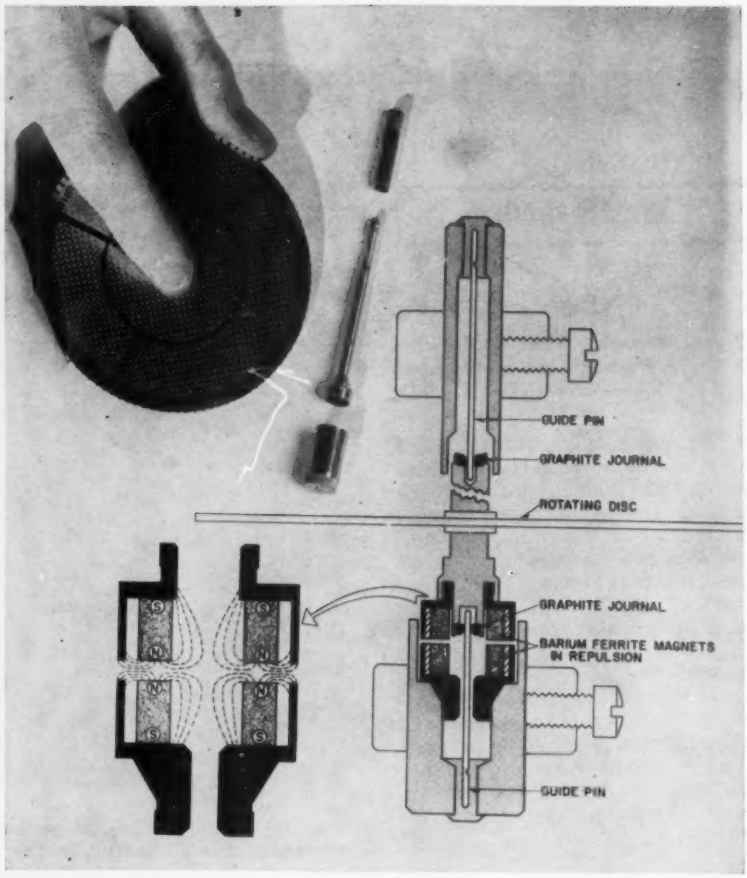


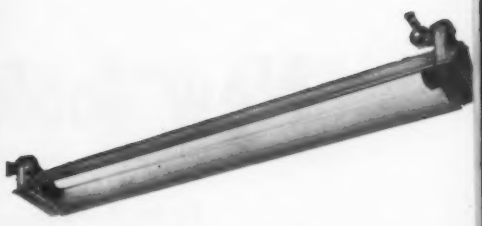
Fig. 3—The schematic diagram at right shows the positioning of the various components of the magnetic repulsion bearing as well as the guide pins that ride in graphite journals. The sketch at left shows the magnetic circuits involving magnets and steel cups.

One variable inherent in all magnetic systems is that of change of strength with temperature. The Magnethrust bearing system has been so designed that the resulting temperature coefficient is negligible. Vertical change in rotor position is thus only a few mils over a wide temperature range.

The barium ferrite magnet is a form of ceramic and therefore has the characteristics of being non-metallic, inorganic, non-conducting, and manufactured by sintering at high temperatures. Because of their oxide nature, such magnets are particularly corrosion resistant and chemically stable.

Coupled with the new bearing itself are other features making for long accuracy life in the new Type D2 meter. Maximum corrosion protection is obtained by such features as die-cast aluminum frames finished with the specially

(Continued on page 133)



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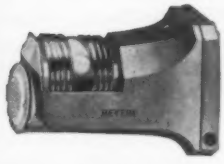
"Fluoresign" Fluorescent Luminaire

Revere No. 9605
Fluorescent Luminaire



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New look in protective relaying

By N. Kreekon
Application Engineer
Switchgear Dept.
Allis-Chalmers Mfg. Co.

◆ FOR OVER 50 YEARS the power engineer has been dependent upon a relay having an induction element such as a rotating disc. Up to now, the induction type relay has provided him with the only reliable and relatively flexible tool for power line and distribution network protection. Now the rapidly growing electronic industry has provided us with components that, when properly applied, have led to important improvements in the basic art of protective relaying.

A major contribution to power and industrial relaying is in the recent development by Allis-Chalmers of a protective relay based on the use of semi-conductor devices—diodes, transistors, thermistors and varistors. Used in combination with these electronic components are conventional circuit elements — resistors, capacitors, and transformers.

Being static, the newly developed relay has features that are superior to the presently used induction disc type relay.

Some of the advantages are:

(1) Reset time instantaneous—coordination.

(2) Lower maintenance — no moving parts.

(3) Calibration requires less skill.

(4) Shock resistant.

(5) Moisture proof.

(6) Less mounting space.

(7) Flexible curve shape.

This article describes the first in a complete line of static relays, the overcurrent relay.

Description of operation

The new static relays are arranged in building block form, as shown in Figures 1 and 2. There are four components in the protective scheme using static relays:

(1) Auxiliary current transformers and resistors.

(2) Static relay.

(3) Trip unit.

(4) Pushbutton for target indication and target reset.

Since a voltage signal is required to operate the relay, a resistor is used to shunt the secondary of an auxiliary current transformer or is connected directly across the secondary of the primary current transformer. The usual current transformer shorting switches can be omitted, since a resistor is connected permanently in the current transformer circuit.

The power of the auxiliary current transformer is fed into the inverse-time circuit of the relay. This circuit remains inactive until the signal becomes greater than tap setting or pick-up setting of the relay.

To make this circuit suitable for protective relaying purposes, its characteristics must be extremely flexible. Its accuracy must be unaffected by temperature variation normally encountered in locations where protective relays are installed.

Excessive overload due to short circuits in the power circuit, and

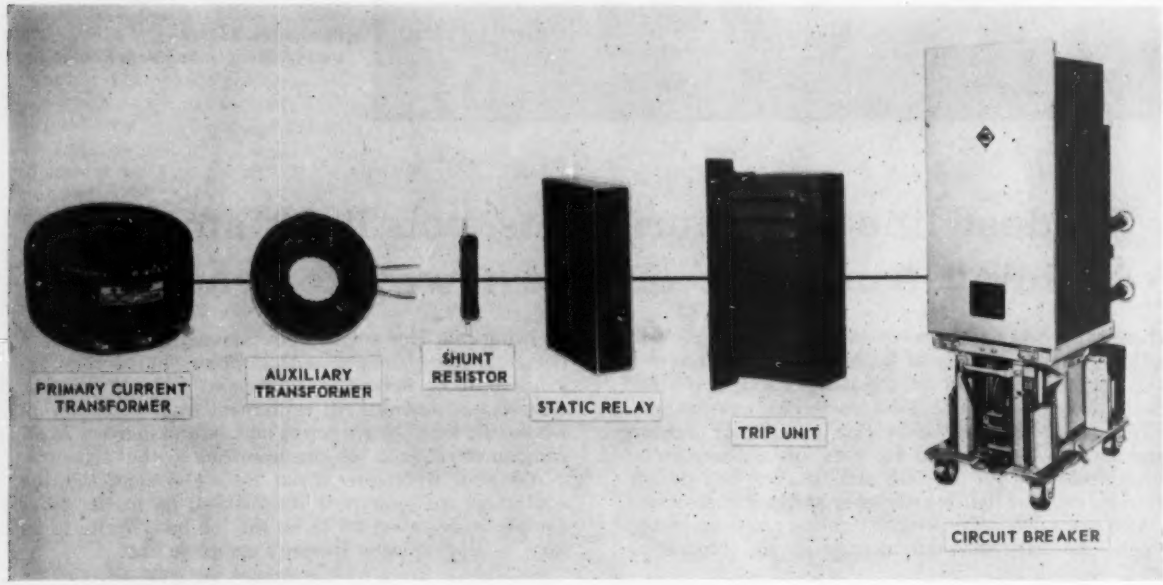


Fig. 1—Here are the elements of a typical overcurrent relay application. Not shown are pushbuttons for read and reset of target lighter. One trip unit can be used with a number of relays, but each circuit breaker must have one trip unit. The components of the static relay are shown in Fig. 2.

equipment

resulting voltage surges must be absorbed in such manner that no damage results to the relay unit, and relay action must be maintained in a predetermined manner.

The output of the static relay is connected to a trip unit which functions like an auxiliary relay. The trip unit is essentially an "on-off" transistor circuit.

Upon receiving a signal from the static relay, the trip unit "conducts," closing the circuit connecting the tripping battery to the trip coil of the breaker. An auxiliary switch which opens with the breaker interrupts the trip circuit. Interruption of the fault in the primary circuit stops the signal from the static overcurrent relay and returns the trip unit to "off" position.

The trip unit is capable of handling a 4-ohm trip coil at 120 volts d-c continuously. The size of the trip unit can be altered to meet ordinary trip current requirements corresponding to different trip voltages. It is preferably mounted close to the circuit breaker. The problem of indication of relay operation by completely static means was solved using a neon target light in combination with a pair of digital computer style memory cores.

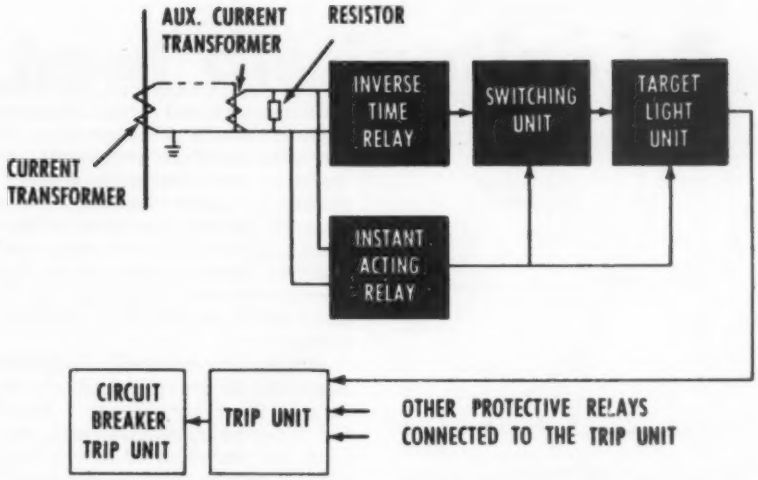


Fig. 2—The components indicated by the black squares are incorporated in the static relay and are potted in epoxy-resin. The relay output is fed to the trip unit which acts as a static switch to close the tripping circuit. Current is used only during trip operation.

Upon operation of the static relay, the signal that caused breaker to trip energizes the memory core. This intelligence is retained indefinitely until a "read" push-button is pressed to release this intelligence. Two indicating lights give target indication, depending on whether trip was time or instantaneous. This light will remain energized until "reset" button is pressed.

Construction details

The components of both the static relay and the trip unit consist of semi-conductors, such as

Fig. 3—This cutaway view of the epoxy-resin filled relay shows the simple adjustment dials. They set time, tap, and instantaneous values.

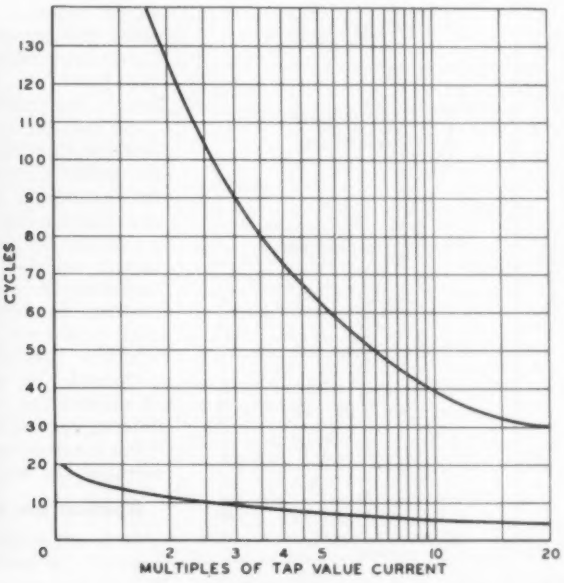
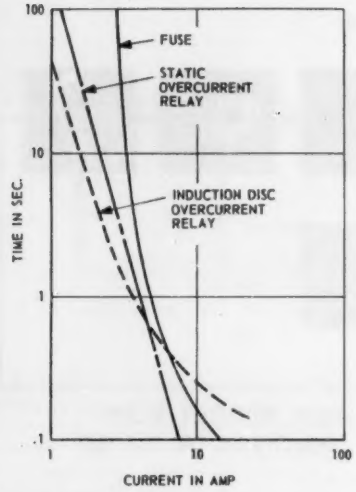
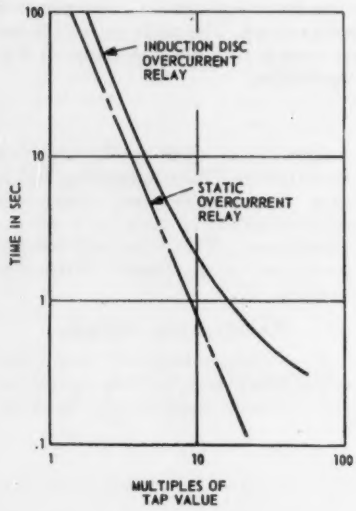


Fig. 4—Curve shape falls along general lines of conventional relays. This curve shows band for typical short-time overcurrent relay.





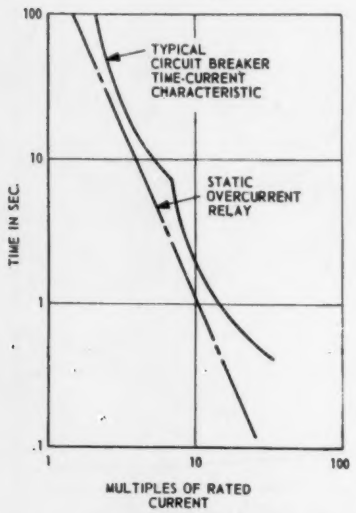


Fig. 5—These diagrams show how the new static relay can be coordinated with other system protective devices.

diodes and transistors, combined with conventional circuit elements, such as resistor and capacitors. All elements are then completely encased in epoxy-resin for a shock-resistant, moisture-proof, sealed unit. No effort was made to miniaturize the relay unit because reliability during operation is improved when ample clearance is provided between all component parts.

Simple, conveniently arranged adjustments are provided on the face of the relay. Figure 3 shows the three adjustments which provide the selection of the proper characteristics required for application.

(a) *Time setting.* This adjustment provides the family of curves for a given inverse characteristic built into the relay. The scale is provided with numbers 1—100, which are relative only.

(b) *Tap setting.* This adjustment has five taps for each relay range. Ranges are .5 to 2.5, 2 to 6, and 4 to 12. The tap setting is provided with positive position locking screw.

(c) *Instantaneous setting.* This adjustment has a continuous adjustment over its entire range.

Performance characteristics

Although the curve shape produced by the new static relay can be any shape desired, the curve shape offered initially will fall along the general lines of conventional type relays. Figure 4 shows the band for typical short-time overcurrent relay.

As can be seen by Figure 5, a straight line characteristic can offer better coordination with fuses for example. The fact that the curve shape can be changed opens a completely new concept in protective relaying. Coupled with the fact that the reset time is instantaneous, performance in coordination problems can be more accurately predicted.

Considering the simple matter of calibrating, any two points as determined with an ammeter and cycle counter are sufficient to determine the curve shape.

Application of static relays

It is expected that the application of the new static relays will fall in line with general relay application practice. It is important to know that the personnel now trained to handle induction relays can be used to test and calibrate the new static relays.

Calibration procedures can be simplified because of the absence of moving parts. The present design of these relays includes five taps for the inverse time unit and a continuous adjustment for instantaneous trip unit. For those applications using auxiliary current transformers, taps can be provided to cover a multitude of ranges.

Since the component parts are completely covered with potting material, maintenance work in combination with these relays will be reduced to an occasional recalibration procedure, which can be done with a standard set of instruments and does not need to be any different from the procedure which is now used in combination with induction disc relays. Mechanical adjustments cannot be made because there are no moving parts other than the time and range controls which can be adjusted to suit application requirements.

Future possibilities

Output of relays could go directly to computer which integrates signals and takes necessary action to readjust system, drop load, add capacity or otherwise alleviate the overload condition.

Although this article describes the overcurrent relay in detail, a complete line of protective relays will be made available. These new relays offer almost unlimited possibilities in application. Some of the advantages are:

(1) Testing time reduced, especially if straight line characteristic is standardized.

(2) Maintenance is reduced, no moving parts to cause trouble.

(3) Calibration requires minimum skill.

(4) Shock resistant.

(5) Moisture proof.

(6) Less mounting space required.

(7) Interconnections can be small control wires.

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(1) "A New Concept for Protective Relay Design", John Baude, presented at the Twelfth Annual Conference for Protective Relay Engineers, College Station, Texas, April 13-15, 1959.

(2) "Let's Change Relay Time-Current Characteristics," John Baude, Allis-Chalmers ELECTRICAL REVIEW, 2nd Quarter, 1959.

Conductor heat dissipation - 5

By Fred C. DeWeese
Consulting Engineer
Raleigh, N. C.

◆ WHEN WIRES AND CABLES are strung in the open, such as overhead lines, they come under a somewhat different category than when installed indoors, since the outdoor temperature varies over a wide range and is completely beyond control. It is, however, generally considered safe to assume there will always be a slight component of air movement across the line conductors during that part of the day when the sun is brightest and maximum temperatures prevail. This is generally the critical period of the day insofar as the permissible current carrying capacity of a given conductor is concerned.

An inspection of Figure 5, which indicates a plan view of a more or less typical overhead distribution circuit layout on city streets, shows that the direction of wind may be parallel or approximately parallel to a certain section of a given line, in which case the wind may act as a deterrent to heat dissipation. Figure 5 illustrates quite clearly the fallacy of striving for too great an accuracy in connection with computing heat dissipation by forced convection in an overhead line.

In any case it is advisable to assume, for the purpose of heat loss calculations, a comparatively low wind velocity, since a load current that may produce only a nominal temperature rise under average conditions may very well result in excessive temperatures under less favorable atmospheric conditions. Authoritative sources generally agree that it is safe to assume a wind velocity of two feet per second (1.36 miles per hour), crosswise to the conductor.

Unit heat dissipation by forced convection in watts per square inch of conductor surface may be derived from the following equation:

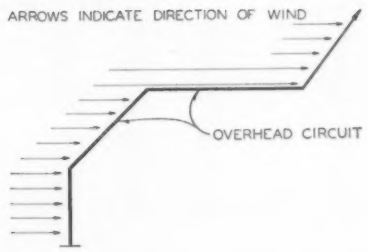


Fig. 5 - At a given moment wind direction may vary widely for a typical overhead distribution circuit following city streets.

$$w_c = \frac{0.0128 \times \sqrt{v} \times \Delta_t}{T_a^{.123} \times \sqrt{d}} \text{ watts per square inch} \quad (4)$$

where v = air velocity in feet per second

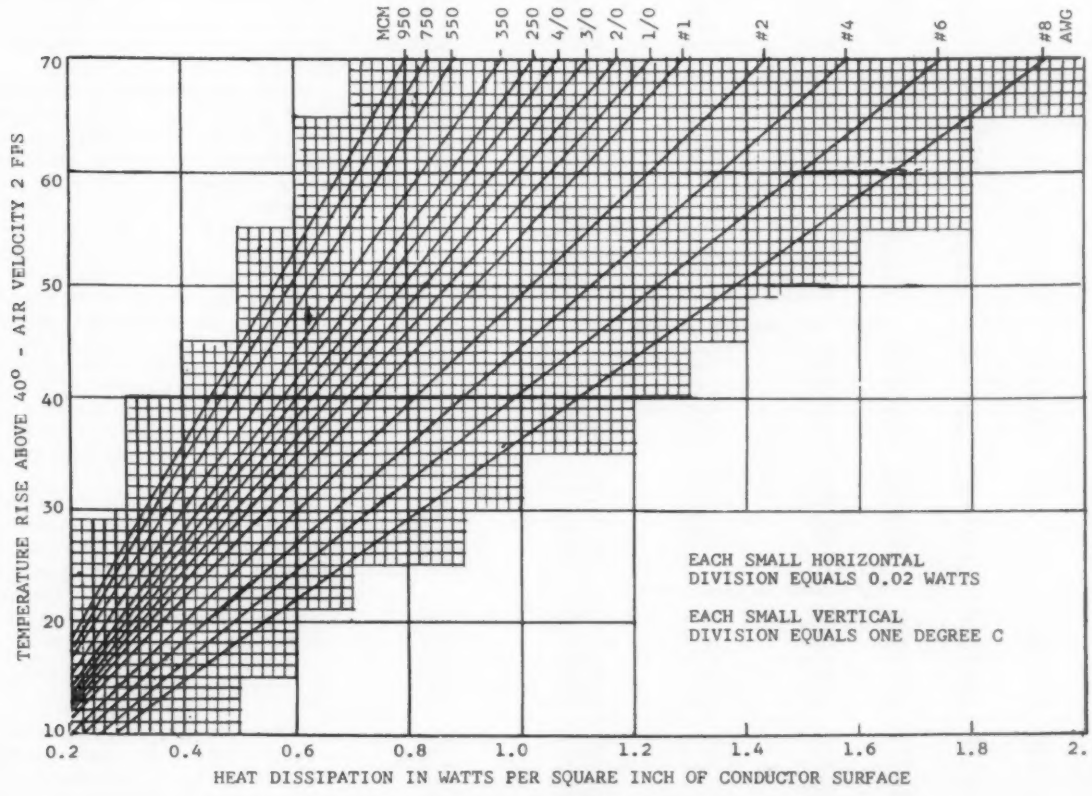

MCM 950 750 550 350 250 4/0 3/0 2/0 1/0 #1 #2 #4 #6 #8 AWG
TEMPERATURE RISE ABOVE 40° - AIR VELOCITY 2 FPS
70
60
50
40
30
20
10
0.2 0.4 0.6 0.8 1.0 1.2 1.4 1.6 1.8 2.
HEAT DISSIPATION IN WATTS PER SQUARE INCH OF CONDUCTOR SURFACE
EACH SMALL HORIZONTAL DIVISION EQUALS 0.02 WATTS
EACH SMALL VERTICAL DIVISION EQUALS ONE DEGREE C

Fig. 6—Heat loss curves for bare copper wire and cables—air velocity 2 fps

Table 7—Values for use in equation (4)

Δ_t	t°C	T	T_o		(0.0128 x $\sqrt{v}$ x Δ_t	.123 T_a	w_r
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
				40°C Basic Air Temperature			
10	50	323	313	318	0.18102	2.0314	0.02367
15	55	328	313	320.5	.27153	2.0334	.03637
20	60	333	313	323	.36204	2.0353	.04965
25	65	338	313	325.5	.45255	2.03725	.06355
30	70	343	313	328	.54306	2.0392	.07808
35	75	348	313	330.5	.63357	2.0411	.09326
40	80	353	313	333	0.72408	2.0430	0.10910
45	85	358	313	335.5	.81459	2.0448	.12564
50	90	363	313	338	.90510	2.0467	.14288
55	95	368	313	340.5	.99561	2.0486	.16085
60	100	373	313	343	1.08612	2.0504	.17957
65	105	378	313	345.5	1.17663	2.0522	.19905
				35°C Basic Air Temperature			
15	50	323	308	315.5	0.27153	2.0294	0.03469
20	55	328	308	318	.36204	2.0314	.04738
25	60	333	308	320.5	.45255	2.0334	.06066
30	65	338	308	323	.54306	2.0353	.07457
35	70	343	308	325.5	.63357	2.03725	.08910
40	75	348	308	328	.72408	2.0392	.10427
45	80	353	308	330.5	0.81459	2.0411	0.12012
50	85	358	308	333	.90510	2.0430	.13565
55	90	363	308	335.5	.99561	2.0448	.15390
60	95	368	308	338	1.08612	2.0467	.17187
65	100	373	308	340.5	1.17663	2.0486	.19058
70	105	378	308	343	1.26714	2.0504	.21007
				30°C Basic Air Temperature			
15	45	318	303	310.5	0.27153	2.0255	0.03307
20	50	323	303	313	.36204	2.0275	.04518
25	55	328	303	315.5	.45255	2.0294	.05788
30	60	333	303	318	.54306	2.0314	.07116
35	65	338	303	320.5	.63357	2.0334	.08506
40	70	343	303	323	.72408	2.0353	.09959
45	75	348	303	325.5	0.81459	2.03725	0.11477
50	80	353	303	328	.90510	2.0392	.13061
55	85	358	303	330.5	.99561	2.0411	.14715
60	90	363	303	333	1.08612	2.0430	.16439
65	95	368	303	335.5	1.17663	2.0448	.18236
70	100	373	303	338	1.26714	2.0467	.20108
75	105	378	303	340.5	1.35765	2.0486	.22056
				25°C Basic Air Temperature			
15	40	313	298	305.5	0.27153	2.0214	0.03150
20	45	318	298	308	.36204	2.0235	.04305
25	50	323	298	310.5	.45255	2.0255	.05517
30	55	328	298	313	.54306	2.0275	.06786
35	60	333	298	315.5	.63357	2.0294	.08115
40	65	338	298	318	.72408	2.0314	.09505
45	70	343	298	320.5	0.81459	2.0334	0.10958
50	75	348	298	323	.90510	2.0353	.12475
55	80	353	298	325.5	.99561	2.03725	.14060
60	85	358	298	328	1.08612	2.0392	.15713
65	90	363	298	330.5	1.17663	2.0411	.17438
70	95	368	298	333	1.26714	2.0430	.19234
75	100	373	298	335.5	1.35765	2.0448	.21106
				20°C Basic Air Temperature			
15	35	308	293	300.5	0.27153	2.0173	0.02998
20	40	313	293	303	.36204	2.0194	.04099
25	45	318	293	305.5	.45255	2.0214	.05255
30	50	323	293	308	.54306	2.0235	.06467
35	55	328	293	310.5	.63357	2.0255	.07736
40	60	333	293	313	.72408	2.0275	.09064
45	65	338	293	315.5	.81459	2.0294	.10454
50	70	343	293	318	0.90510	2.0314	0.11907
55	75	348	293	320.5	.99561	2.0334	.13425
60	80	353	293	323	1.08612	2.0353	.15010
65	85	358	293	325.5	1.17663	2.03725	.16663
70	90	363	293	328	1.26714	2.0392	.18387
75	95	368	293	330.5	1.35765	2.0411	.20184
80	100	373	293	333	1.44816	2.0430	.22056
				15°C Basic Air Temperature			
20	35	308	288	298	0.36204	2.0152	0.03900
25	40	313	288	300.5	.45255	2.0173	.05002
30	45	318	288	303	.63357	2.0194	.06157
35	50	323	288	305.5	.63357	2.0214	.07369
40	55	328	288	308	.72408	2.0235	.08638
45	60	333	288	310.5	.81459	2.0255	.09967
50	65	338	288	313	.90510	2.0275	.11356
55	70	343	288	315.5	0.99561	2.0294	0.12809
60	75	348	288	318	1.08612	2.0314	.14327
65	80	353	288	320.5	1.17663	2.0334	.15912
70	85	358	288	323	1.26714	2.0353	.17749
75	90	363	288	325.5	1.35765	2.03725	.19289
80	95	368	288	328	1.44816	2.0392	.21086

Δ_t = temperature rise in degrees C.

$T_a = (T + T_0)/2$ = average absolute temperature in degrees C.

d = diameter of conductor in inches.

This equation is an approximation, said to be applicable for use with wires and cables having diameters above about ¼ inch and wind velocities in the order of 0.5 feet per second and above. An important item to be kept in mind, however, as previously discussed, is that the results derived from its application will very likely correspond more nearly with true values for the assumed conditions than the assumed conditions correspond to actual wind velocity and temperature.

Wind effect

It will be seen from equation (4) that the heat dissipation w_c varies directly with the square root of the wind velocity; and from equation (2) that the heat dissipation by radiation, varies directly as the emissivity constant "e". Since "e" is appreciably affected by the color of the conductor surface, a conductor that has been in service only a comparatively short length of time will have lower heat dissipation by radiation—in the order of 60 per cent of that for a conductor with normally weathered surface.

When the problem is considered from a viewpoint of the non-conformity of assumed conditions with the average atmospheric conditions along a given line, it would seem to make little difference whether the equation is an approximation, since only approximate results could be expected in any case.

As in the case of equation (1), applied to computing heat dissipation by free convection, it is advisable to compute and tabulate values that are common to a given temperature rise, the use of which results in the mathematical work being greatly reduced. (See Tables 7, 8, and 9.)

The values in Table 7 are common to all conductor materials. Table 8 is for use with copper and Table 9 is for use with aluminum conductors. The table values are for use in equation (4) for a given temperature rise above basic air temperatures of 40°C (104°F); 35°C (95°F); 30°C (86°F); 25°C (77°F); 20°C (68°F) and 15°C (59°F). These basic values provide a range that should suffice for use at high, moderate, and winter time temperatures that may be encountered in the United

Table 8 — Square root of diameter Copper wires and cables

AWG or MCM	$\sqrt{d}$	MCM	$\sqrt{d}$	MCM	$\sqrt{d}$
8	0.35845	400	0.85313	1250	1.13543
7	.37984	450	.87862	1300	1.14563
6	.40252	500	.90207	1400	1.16807
5	.42654	550	.92444	1500	1.18839
4	.45200	600	.94477	1600	1.20796
3	0.47898	650	0.96387	1700	1.22640
2	.50757	700	.98186	1750	1.23538
1	.57274	750	.99897	1800	1.24405
1/0	.60693	800	1.01522	1900	1.26099
2/0	.64315	850	1.03073	2000	1.27726
3/0	0.68153	900	1.04556		
4/0	.72221	950	1.05979		
250	.75730	1000	1.07347		
300	.79264	1100	1.09973		
350	.82378	1200	1.12391		

Table 9 — Square root of diameter Aluminum cables

AWG or MCM	$\sqrt{d}$	MCM	$\sqrt{d}$	MCM	$\sqrt{d}$
6	0.42862	336.4	0.81566	1000	1.07347
4	.48131	350	.82512	1033.5	1.08162
3	.51004	397.5	.85042	1113	1.10257
2	.54048	477	.89007	1192.5	1.12177
1	0.57274	500	0.90061	1272	1.14015
1/0	.60693	556.5	.92504	1351.5	1.15742
2/0	.64315	636	.95799	1431	1.17408
3/0	.68153	715.5	.98662	1510.5	1.19006
4/0	0.72221	750	0.99831	1590	1.20542
250	.75855	795	1.01295		
266.8	.76530	874.5	1.03738		
300	.79264	954	1.06019		

Note: Where two cables of the same cross section are available, the table value applies to the one with the smallest number of strands.

States and foreign countries.

By application of the values in Tables 7, 8, and 9 it is a simple matter to compute the heat dissipation by forced convection of a given conductor at a given temperature rise above the basic air temperature that would seem to more nearly correspond to atmospheric conditions in the section of the country where the study is under consideration. (Column (6) of Table 7 gives ($0.0128 \times \sqrt{v} \times \Delta_t$), the numerator of equation (4), at a given temperature rise. Column (8) gives values of w_r, unit heat dissipation by radiation, which are independent of the conductor diameter and derived from equation (2). Table 8 gives the square root of the diameter "d" of copper wire and cable. Table 9 gives the square root of "d" of aluminum cables.

Solution to the following example will demonstrate the procedure and application of the table values.

Example 4: For a 500 MCM hard drawn copper cable, with temperature rise 30°C above air temperature of 40°C., and air velocity 2 feet per second, it is required to find the following: w_c = heat dissipation by forced convection in watts per square inch; w = total unit heat dissipation in watts per square inch; and I = permissible

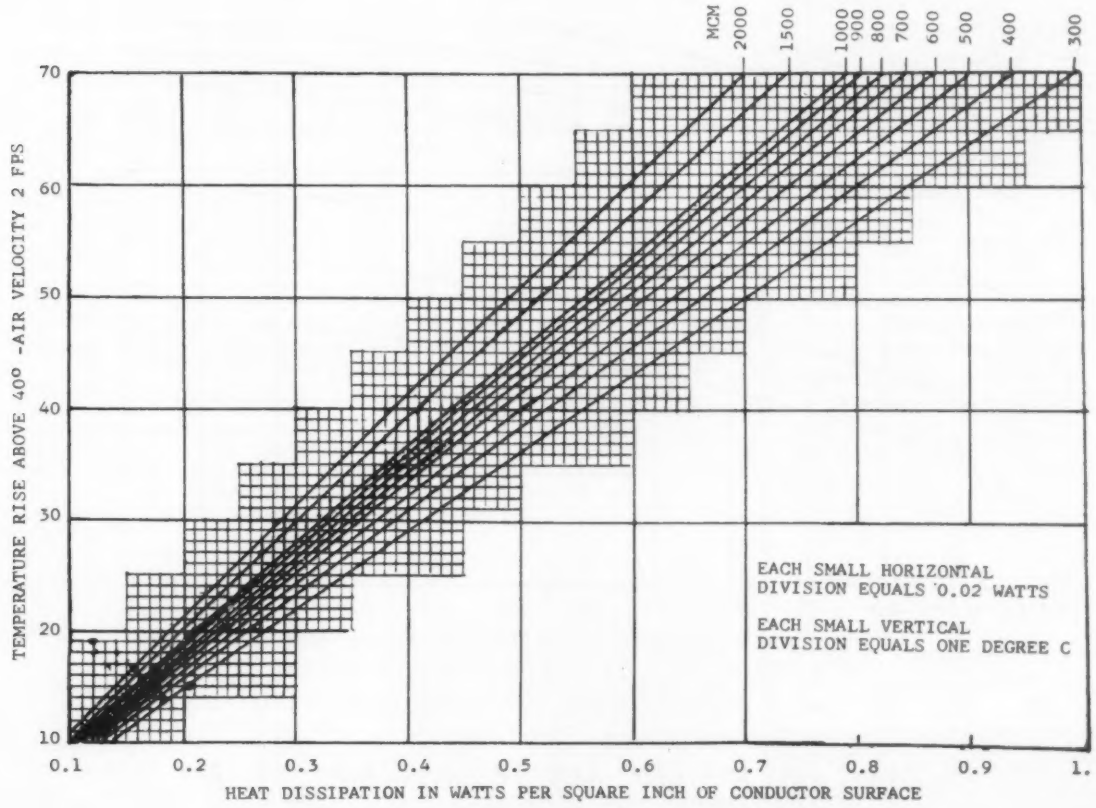


Fig. 7—Heat loss curves for bare copper cables—air velocity 2 fps

current carrying capacity in amperes.

From Table 7, column (6), the numerator ($0.0128 \times \sqrt{v} \times \Delta_t$) = 0.54306; column (7) $T_a^{.123}$ = 2.0392; and column (8) w_r = 0.07808 watts per square inch. From Table 8, 500 MCM copper cable, $\sqrt{d}$ = 0.90207. Substituting in equation (4), we have

$$w_a = \frac{0.54306}{2.0392 \times 0.90207}$$

$$= 0.29522 \text{ watts}$$

From column (8), w_r = 0.07808 watts, and $w = w_a + w_r$ = 0.37330 watts total per square inch.

The 60-cycle resistance of 500 MCM hard drawn copper, at 70°C is 0.13895 ohm. From Table 2, column (10), we find a value of 161,975 square inches per mile, from which

$$I = \sqrt{\frac{161{,}975 \times .3733}{0.13895}}$$

= 660 amperes at 60 cycles.

From Table 4, the relative current carrying capacity of hard drawn copper, 97.3 per cent conductivity, is given as 98.86 per cent. Then 660/0.9886 = 668 amperes, which checks the value on the curve, Figure 8.

What will be the current carrying capacity of a 500 MCM aluminum cable under the conditions as given in Example 4?

$$I = \sqrt{\frac{161{,}975 \times 0.3733}{0.22142}}$$

= 522 amperes at 60 cycles.

The unit heat dissipation w,

(Continued on page 132)

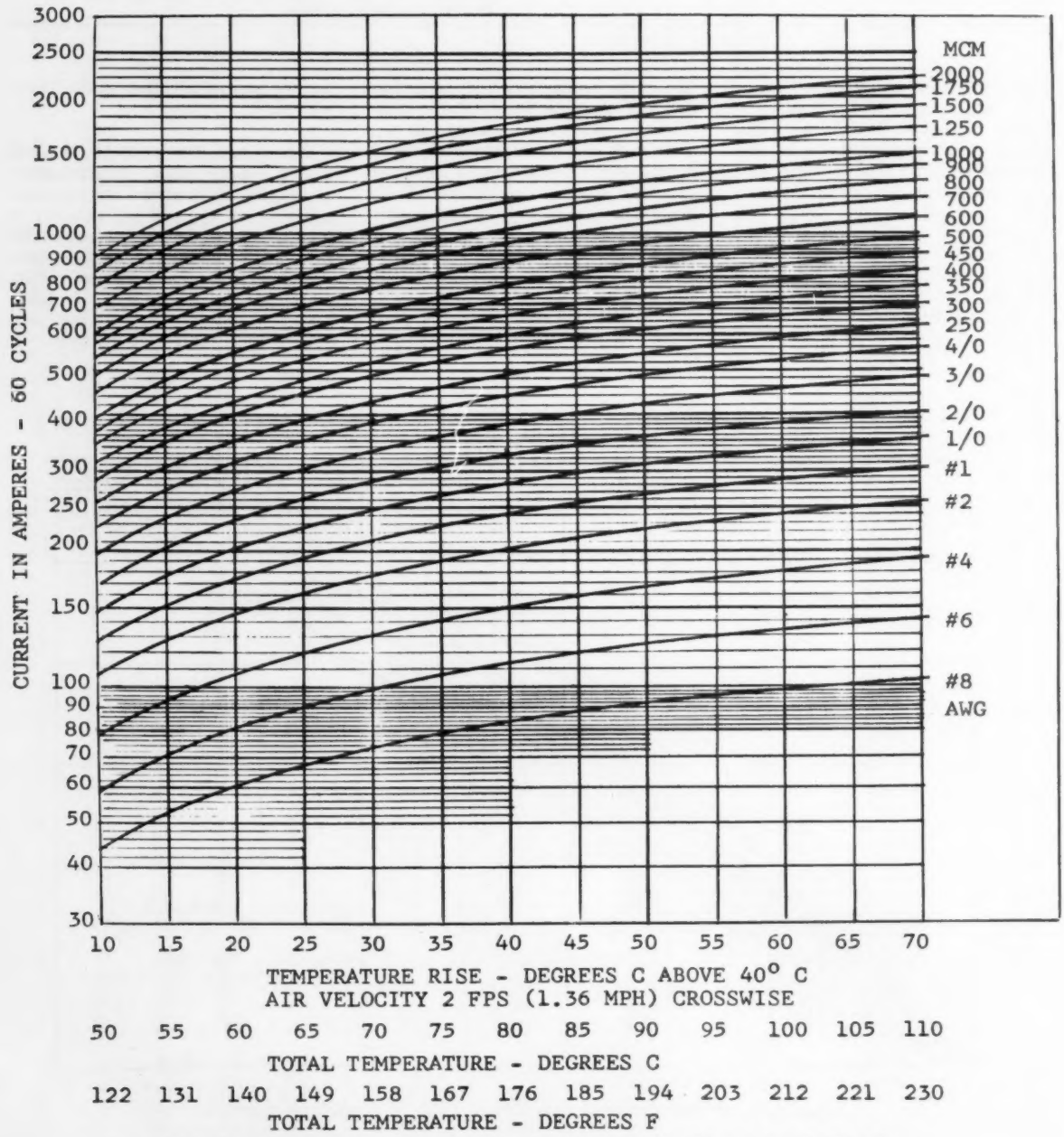


Fig. 8—Temperature-current curves for copper wire and cables—air velocity 2 fps

New utility equipment

G-E impulse generator

A new, high-accuracy system to generate impulses for the operation of demand meters, totalizing relays, and data counting and printing has been developed by General Electric Co., 1 River Rd., Schenectady 5, N. Y.

The new Impulse Generator, designated type D-41, is applicable to large consumer billing, tie-line metering between utilities, electric generation, load survey, and kilowatt demand load control systems. The

device can be used where conditions of oscillation or float of in-out power occur with no impairment of accuracy.

The system can feed up to 10,000 impulses per hour with as high as 10 impulses per disk revolution into demand meters. Since each impulse represents a cost division of electric power, users can now attain greater accuracies from impulse operated metering equipment.

Features of the impulse generator are extremely low friction, minimum maintenance, and long life. Under normal conditions and with only minor adjustments it is expected to generate approximately 100 million impulses without malfunctioning.

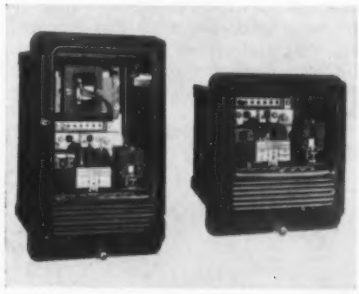
In operation, infrared signals pass through a series of radial slots on a shutter wheel and impinge upon a photocell to operate the relay. The relay's single-pole, double-throw contact then operates the end device. Design of the optical system eliminates effects of stray light from sun or room illumination.

Write in No. U-901 on card, pg. 17

Westinghouse power relays

New power relays (Type CW) to detect excessive or reverse power flow for single- or three-phase application are offered by the Westinghouse Electric Corp., P. O. Box 2099, Pittsburgh 30, Pa. Both CW relays are self-contained (requiring no external reactors) and are available for 120- or 208-volt systems.

The CW relay for single-phase application uses line voltage and line current. It operates on single-phase watts, with maximum torque occur-



ring when the voltage and current are in phase.

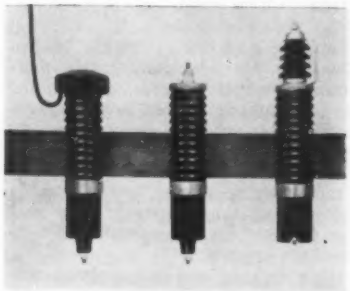
The relay for three-phase application uses phase-to-phase voltage and line current, with maximum torque occurring when the relay current leads the relay voltage by 30 degrees at system unity power factor. It operates on single-phase watts multiplied by $\sqrt{3}$. One CW relay is required for balanced three-phase systems, and three are needed when unbalanced three-phase conditions exist.

Some design features include a tap block which indicates watt values; an adjustable time delay; silver moving contacts that close 30 amperes at 250 volts d-c; silver stationary contacts with sufficient wipe to assure positive contact; and a one piece die-cast aluminum frame which assures accurate alignment of moving parts and stationary components.

Write in No. U-902 on card, pg. 17

Joslyn valve arresters

A complete valve arrester line from 3 to 18 kv utilizing a series of short quench and isolating gaps in unit structures with electrostatic shielding to obtain low impulse sparkover is now offered by Joslyn Mfg. and



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"Fanner Superformed products meet our standards all along the line . . . *technical superiority, accurate manufacture, uniform quality, dependable performance.*"

More and more Standards Engineers . . . *the men who must find BETTER ways to do things BETTER* . . . are testifying that Superforms meet the highest standards. A-1580A

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ARMOR RODS . . . Protect long-span T&D lines at supports

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TAP ARMOR . . . Protects conductor at tapping points

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FANNSPLICES . . . Join two ends of conductor wire

PLASTIC PRODUCTS . . . For conductor surface protection

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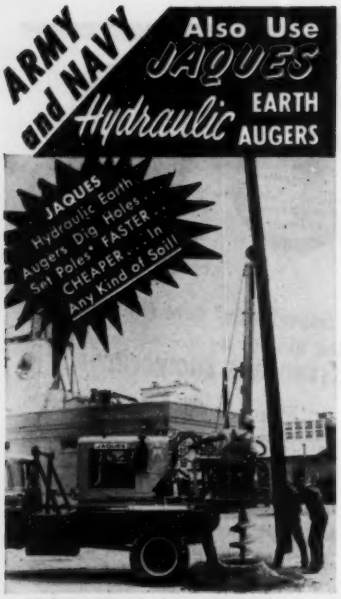
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*Pole-setting attachment optional.

ARMY REPORT ON JAQUES KJ-254**

"There was a performance test on Pilot Model (Jaques Earth Auger), Model KJ-254, built by Texoma Enterprises, Inc. This test performed in accordance with Military Specification Mil-A-516B, paragraph 3.9 through 3.9.2.

"This test was performed in sandy, gravelly, red clay, hard and dry to blue silty clay at bottom of hole. Average time per hole for 25 consecutive holes was 78 seconds. Average depth of holes was 67.2 inches. Machine functioned at normal temperature."

**JAQUES newly developed Model TJ-254 is 2½-TIMES FASTER than Model KJ-254!

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WHY BUY JAQUES?

1. JAQUES Augers have finger-tip, feather-touch controls... only 3 primary adjustments for easy, simple operation ... Mount on standard trucks...
2. JAQUES drill holes up to 60" diameter ... up to 25' deep in toughest soil... even in rock... FASTER, CHEAPER...
3. JAQUES have fewer moving parts for longer life... lower maintenance and operation costs... less "down time"...
4. JAQUES dig holes up to 45° angle, either side of truck... Patented pressure control takes strain off all parts when rock drilling...
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Supply Co., 155 North Wacker Dr., Chicago 6, Ill. Use of the distinctive "Micro-Pack" valve element of silicon carbide insures high thermal capacity and low discharge voltage characteristics.

The direct-connected types are available with either stud connectors or insulated line leads—both with automatic ground lead disconnectors.

Write in No. U-903 on card, pg. 17

Improved HD Max-I-Meter

A newly - designed "inverted housing" for its Max-I-Meter models has been announced by HD Electric Co., 760 Osterman Ave., Deerfield, Ill., manufacturers of primary voltage ammeters and related testing instruments.

The new "inverted housing" of HD's Max-I-Meter, containing meter

element, is designed to face directly downward or towards ground level. This new "inversion" feature makes it possible to take accurate meter dial readings from ground level, company officials say.

The new "face down" position or "inverted housing" feature is immediately available on virtually all Max-I-Meter models.

Write in No. U-904 on card, pg. 17

Pad-type transformer

A new economical transformer designed especially for commercial suburban areas with heavy low voltage load concentration has been introduced by Allis-Chalmers, 938 S. 70th St., Milwaukee 1, Wis.

Low in cost and versatile in application, the new commercial pad-mounted transformer is suitable for use in shopping centers, hotels, drive-in theaters, schools, motels, etc. All unnecessary gauges and accessories have been eliminated. This results in a modern uncluttered exterior with locked and tamper-proof high and low voltage enclosures. No vault or fence is required.

High voltage and low voltage dry

type enclosures accommodate either cable or bus work. The entire enclosure lifts away from the transformer for complete freedom in making connections.

Commercial pad mounted transformers are available in three phase sizes, 225 through 1500 kva with high voltage 2400 through 13,800 (no taps) and with a low voltage of 208Y/120 or 480Y/277.

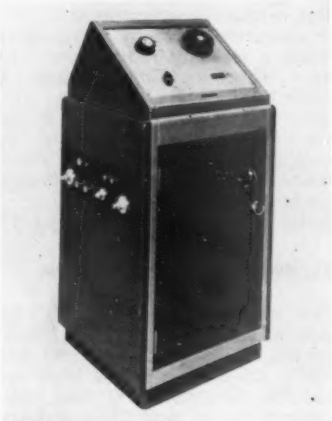
Write in No. U-905 on card, pg. 17

Knopp transformer tester

The Uniload current transformer testing equipment, Type AL-2, made by Knopp, Inc., Oakland 8, Calif., now offers increased ranges to 4000 amperes.

It offers great convenience and safety in all applications where test loading is involved and accurate measurement of the current over a very wide range is needed. It contains a heavy-duty current-loading transformer, a high-accuracy Knopp precision multirange current transformer standard, a variable-transformer current control, switches, and overload protection, all housed in an attractive, compact console cabinet. It is carefully designed, precision engineered and thoroughly tested.

This equipment has all of the necessary current ranges from 10 to 4000 amperes inclusive, and it may be used



to perform tests, in conjunction with the Knopp transformer comparator. The Type AL-2 provides tests at any load from light load to 200 per cent load on current transformers with ranges of 2000 amperes and below and that match the current ranges of the equipment.

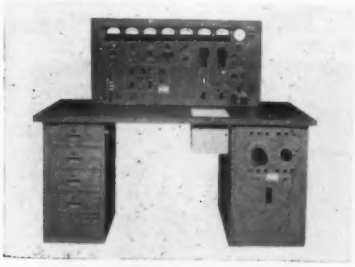
Write in No. U-906 on card, pg. 17

Protective relay test table

A relay test table with built-in instrumentation is available now for checking practically 99 per cent of all protective relays used on electric power systems. It is a recent addition to the line of test equipment produced by Multi-Amp Electronic Corp., Union, N. J.

This test table is a laboratory type unit, with transformer loading for potential circuits and instantaneous elements; also resistance loading for current sources.

The current section has a 120-volt source adjustable in 0.25-ampere increments, a 200-ampere low-voltage



supply for setting instantaneous elements, and a 4-ampere 8-volt d-c filtered supply for target and seal-in. Voltage section supplies up to 300 volts d-c filtered, up to 270 volts 3-phase at 0.25 kva, and up to 270 volts single-phase at 1.5 ampere.

A special output circuit is provided to test over, under, over/under voltage relays. A test position switch enables the operator to set normal voltage on the relay and then set fault voltage on the relay while holding the normal setting. When fault voltage is applied, timing starts and is automatically removed when the relay contacts close.

Instrumentation includes the timer to measure elapsed test time from 0.01 sec or 0.25 cycle to 60 sec; also ammeters and voltmeters for load and d-c filtered power, a megohm meter for insulation resistance, and a phase angle meter. A phase shifter 200 volt-ampere, 3-phase, is included.

Write in No. U-907 on card, pg. 17

Lindsey suspension clamp

A new side-opening suspension clamp made by Lindsey Manufacturing Co., Pasadena, Calif., is now available for hot line work. One of the safest clamps for hot line handling, it is also one of the fastest to

install, due to extreme simplicity of design.

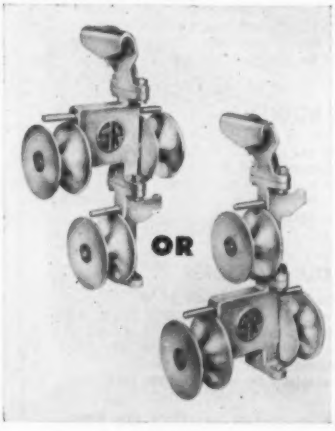
Only one bolt needs tightening to secure the conductor. The Lindsey side opening suspension clamp No. 5880 eliminates the need for an intermediate link between clamp and insulator.

Write in No. U-908 on card, pg. 17

Aerial cable stringing block

Sherman and Reilly, Inc., Chattanooga, Tenn., announce the introduction of Model MH-303 spacer type aerial cable stringing block. This block can easily be changed in the field for stringing either the diamond or inverted wye configurations.

Aluminum alloy throughout offers high strength and light weight. Guards are provided at each sheave position and at the messenger. This is particularly important when working in heavily wooded areas where



spacer type aerial cable is often preferred for lines through trees.

Each sheave is mounted on antifriction ball bearings, permitting accurate sagging. This also makes possible long continuous pulls. Spacer ropes can be attached at either the top or bottom of the block.

Write in No. U-909 on card, pg. 17

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"We like to do business with the Fanner Superformed Folks"... PURCHASING AGENT

"Our transmission-line construction is done on a 'bid-job' basis. But we insist on reliable sources for *every item* of work and equipment, because we must protect customer service and large investments.

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ARMOR RODS... Protect long-span T&D lines at supports

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FANNSPLICES... Join two ends of conductor wire

PLASTIC PRODUCTS... For conductor surface protection

FANNER
The Fanner Manufacturing Co.
Brookside Park—Cleveland 9, Ohio
Division of Textron, Inc.

Compression hot line clamps

A new series of compression hot line stirrup clamps is announced for Anderson Electric Corp., Birmingham, Ala.

Designated as Series CPTS, the new clamps are an adaptation of Anderson's snap-on design CPT compression clamp. Stainless steel pins snap over the main and hold the clamp in place until it is compressed. These new clamps are further equipped with plated copper bails which are staked into the clamps at the factory. Bail is adjustable so that any desired angle may be selected before compression is completed. Installation can be made with many available tools and dies. CPTS clamps are available in range of sizes to accommodate most main and copper tap combinations.

Write in No. U-910 on card, pg. 17

ALCOA conductor connector

"Jiffy Joint," a new aluminum conductor connecting device is the latest development by Aluminum Company of America, Pittsburgh 19, Penn., for the electrical industry.

The single sleeve joint will develop the full mechanical and electrical properties of the composite joint it is designed to replace. It makes splicing of ACSR (Aluminum Conductor, Steel Reinforced), with single steel strands, as rapid and simple as splicing copper or all-aluminum conductors. Jiffy Joint is available in sizes to join conductors from No. 4 (6/1 stranding) through 477 MCM (18/1 stranding).

Design advantages incorporated in the new joints include internal taper of the sleeve and distribution of filler compound on the inner wall, to permit easy insertion of conductor to the center stop.

Write in No. U-911 on card, pg. 17

Molded meter transformer

A new 600-volt, butyl-molded potential transformer, designed to meet the specific needs of electric utilities ad switchboard manufacturers, will be available in quantity in August from the General Electric Co., 1 River Rd., Schenectady 5, N. Y.

Designated Type JVP-O, the new indoor-outdoor potential transformer is designed for single or multiple metering applications. The ASA accuracy classification is 0.3 W and X.

Impulse level is 10-kv full wave. The JVP-O is available either unfused for outdoor application or with one or two primary fuses for indoor use.

Twenty per cent smaller and lighter than comparable models, the new transformer was designed after months of consultation with utilities and switchboard manufacturers to determine their specific needs.

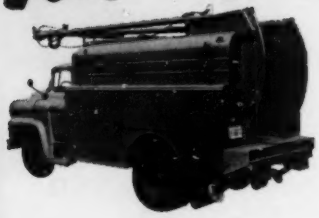
The JVP-O has provision for sealing secondary terminal cover. Voltage ratings of the transformer are 240:120, 288:120, 300:120, 480:120 and 600.120. The outdoor model has a heavy stainless steel base with key and slotted holes to provide maximum mounting flexibility. Provision also has been made for a secondary conduit box on the outdoor model.

Write in No. U-912 on card, pg. 17

Improved sealing compound

Contax, an improved sealing and oxide inhibiting compound which has no harmful effect on rubber products, has been developed in the laboratories of the Jasper Blackburn Corp., 1525 Woodson Rd., St. Louis 14, Mo. Extensive salt fog and current cycling

Koenig ALL-STEEL UTILITY BODIES



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Tests conducted by an independent rubber goods manufacturer indicate that this non-petroleum base grease has no adverse effect on linemen's natural or synthetic rubber gloves and blankets.

Write in No. U-913 on card, pg. 17

L-M pole top luminaires

Internally ballasted mercury luminaires for pole top mounting are now manufactured by Line Material Industries, 700 W. Michigan St., Milwaukee 1, Wis. These fixtures, designated Line 2E2, are designed for high-level lighting of streets, highways, and parking areas. Providing fine appearance during the day as well as superior lighting performance at night, they accommodate clear or color-improved mercury lamps rated 700 and 1000 watts and produce IES types III and IV light patterns.

Installation economy is achieved because these luminaires provide a 35-foot mounting height when installed on 30-foot poles. The luminaires are equipped with one of the first true glass refractors developed for 1000-watt mercury lamps, thereby providing high efficiency, even light distribution, and low brightness.

A permanent-mold cast-aluminum base encases ballast, terminal block, and collet-type clamps for attaching luminaire to steel or aluminum poles. Two support arms, fabricated from expanded aluminum tubing, rigidly secure the spun aluminum top cover and optical assembly to the base. An automatic latch on the refractor as-

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41 Long Ave., Hillside, N. J., ELizabeth 4-7837

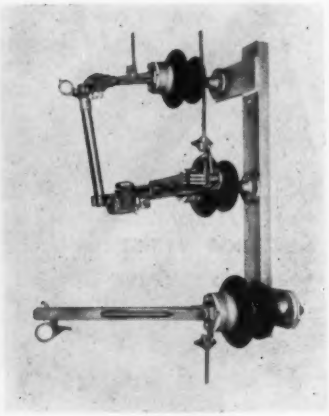
sembly and a hinged reflector facilitate cleaning and lamp replacement. The luminaires are furnished with or without an integral photoelectric control.

Write in No. U-914 on card, pg. 17

Disconnect and power fuse

Type BLP OCR by-pass switch made by the A. B. Chance Co., 210 N. Allen St., Centralia, Mo., combines a by-pass and power fuse into one unit for greater convenience and economy in isolating Oil Circuit Reclosers for inspection and maintenance. When used in conjunction with a conventional SPST hookstick-operated disconnect, it provides (1) by-passing of the OCR; (2) disconnecting of recloser leads; and (3) power fuse protection while the recloser is out of service.

The Type BLP is available with the fuse unit mounted either to the



right or to the left of the center base of the switch. This permits maximum flexibility of arrangement on the structure for accessibility and to maintain electrical clearances.

These switch-fuse combinations are available in voltage ratings of 7.5, 15 and 23 kv; in continuous current fuse ratings of 100 and 200 amperes; and in continuous current switch ratings of 200 amperes.

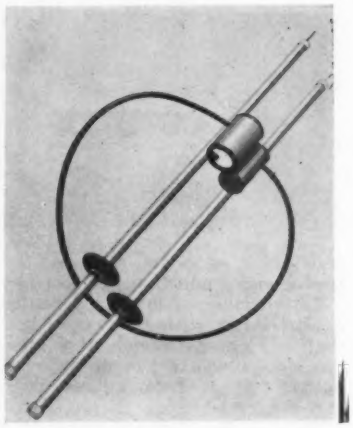
Write in No. U-915 on card, pg. 17

Bodendieck 35-kv voltmeter

A new voltmeter to check actual voltages in substations and on transmission lines with accuracy and safety has been developed by the Bodendieck Tool Co., Rt. 49, Taylorville, Ill.

The new voltmeter consists of medallion fiberglass hot stick handles, each with a series of high voltage resistors and a high voltage jumper between them. The meter is calibrated carefully to indicate RMS 60 cps sinusoidal kilovolts.

The fiberglass handles are rated at 100 kv each foot, while the cable is



rated 35 kv. At maximum voltage, the strand carries only a fraction of the millamperage representing threshold of control loss to a human. More than 12/64-inch polyethelene insulation lays over the strand, further reducing possible leakage to a negligible amount.

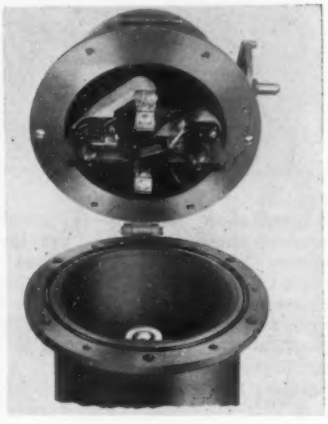
One-man operation is practical, since the jumper is semi-stiff, and is therefore controllable.

Many field applications are possible with the new voltmeter, including phasing, line surveys, and verification that lines are deenergized before application of safety grounds.

Write in No. U-916 on card, pg. 17

Heavy-duty oil fuse cutout

Full 110 kv BIL and heavy interrupting duty are features of the new Type FC72, 15 kv oil-fuse cutout announced by G&W Electric Specialty Co., 3500 West 127th St., Blue Island, Ill. Impulse withstand level of the cutout is 110 kv under the standard 1-½ X 40 microsecond wave and it has a 60-cycle one-minute withstand



of 50 kv. The cutout can interrupt 7000 amperes asymmetrical single-phase (4200 amperes symmetrical, or 100,000 kva symmetrical on three-phase applications.

Write in No. U-917 on card, pg. 17

Know the law

by Arthur L. H. Street

Lien law protects when complied with

THE PROBLEM: The owners of land leased it to a realty company for 99 years. The company erected a building on the premises and subleased it for five years at a total rental of $90,000. The sublease specified that the sublessee should not alter or improve the premises without the written consent of the sublessor, but that consent should not be unreasonably withheld. No alteration or improvement was contemplated by the parties when the sublease was made.

The sublessee contracted with a general contractor for improvements without consulting the sublessor realty company and it was not notified by the contractor that the latter would claim any lien right against the sublessor's leasehold interest in the premises. Did the contractor acquire such a lien?

COURT'S ANSWER: No. So decided the Florida District Court of Appeal, Third District, in the case of Tom Joyce Realty Corp. v. Popkin, 111 So. 2d 707.

The court ruled that the case was governed by the same rules as would apply to a case where the owner of premises leases them and the lessee contracts for alterations or improvements in violation of terms of the lease. The gist of the court's reasoning appears in the following extracts from its opinion:

The Mechanic's Lien Law provides "such liens shall extend to, and only to, the owner's right, title or interest existing at the time of the visible commencement of operations or thereafter acquired in the real property. . . When an improvement is made by a lessee, in accordance with a contract between such lessee and his lessor, liens shall extend also to the interest of such lessor."

The decisions of the Florida Supreme Court have uniformly declared that for a contractor to be entitled to a lien on the improved realty as against the owner when the work is done for a lessee, it must appear that the original lease required the work to be done or the lease made it obvious that the improvements were the pith of the lease.

The court can not find any decision declaring that an owner or lessor subjects his property to a mechanic's lien for work done by a contractor for a lessee merely because he knows such work is being done and fails to take steps to stop such work. The Supreme Court has said on other occasions, that a contractor, laborer, or materialman may receive full, adequate, and complete protection at all times if he will but take the trouble to comply with the provisions of the mechanic's lien law which creates the lien in his favor in the first instance.

Building fire insurance didn't include UG cable

THE PROBLEM: A country clubhouse received electric current from a high line stretching across its land for about 500 feet by underground cable. Forty feet from the building the voltage was reduced by a transformer on a pole to 110 volts from the 7,200 volts carried by the cable. Thence three wires carried current to the building for various uses.

Fire insurance policies specified that "building coverage" should include electric wiring, electric sound equipment, and fixtures used for service of the building while contained therein. Midway along its length, the underground cable was damaged by lightning. Did the policy cover the loss?

COURT'S ANSWER: No. So decided the Iowa Supreme Court in the case of Indianola Country Club, 92 N. W. 2d 402

The court rejected argument that there was coverage by the provision insuring permanent fixtures within and outside the building. That coverage, the court said, was limited to fixtures constituting a permanent part of the building. In short, the wiring from the transformer pole to the building could be regarded as its fixtures, but not the underground cable. The court said:

"The underground cable was undoubtedly installed and imbedded in the ground with the intention that it should remain there permanently. It was attached to the realty in such a way that it became a fixture to the realty and would pass by any conveyance of the realty as a part thereof. But the insurance policies did not cover the realty. They merely insured the building and its contents and its fixtures. The cable was not attached to the building and cannot be said to be a fixture to said building. The word 'fixture' has a flexible meaning and must be construed in the light in which it was used.

When the contracts were entered into with the insurance companies, the parties surely must have understood that what was being insured was the building and its fixtures only and not fixtures to the realty wholly disconnected from the club house building."

Rights on Federal contractor's bond

THE PROBLEM: The Miller Act, a federal law covering claims arising under payment bonds given by prime contractors on federal jobs, provides that any person having direct contractual relationship with a subcontractor but no contractual relationship express or implied with a contractor furnishing a payment bond shall have right to sue on the bond upon giving written notice to the contractor within 90 days from the date on which he last furnished material for which a claim is made. Materials were furnished to an electrical subcontractor for use on a single project, but on separate orders. Did the supplier of the materials preserve its right against the prime contractor's payment bond by giving a single notice?

COURT'S ANSWER: Yes. (United States v. Bregman Construction Corp., 172 Fed. Supp. 517, decided by the United States District Court, Eastern District of New York.)

Gist of the decision: Where the prime contractor furnished gov-

(Continued on page 132)

Understanding the Code

By Walter R. Stone

This article should be especially helpful to the following readers:

- Electrical Contractors ✔
- Electric Utilities ✔
- Electrical Wholesalers ✔
- Electrical Inspectors ✔
- Industrial Engineers ✔
- Consulting Engineers ✔

◆ IN OUR DISCUSSION on motors in the August issue, we discussed general motor requirements, motor branch-circuit and feeder requirements, and some of the motor-running overcurrent (overload) protection requirements. We will continue with the requirements for motor-running overcurrent protection in this issue and then proceed to other motor rules.

A rather unusual Code rule is stated in the exception to Section 430-36 as follows: "Where fuses are used for motor-running protection, a fuse shall be inserted in each ungrounded conductor.

"Exception: A fuse shall also be inserted in a grounded conductor under the circumstances set forth in the note following Table 430-37 for circuits supplied by wye-delta or delta-wye connected transformers."

This note following the table states, "In the case of distribution systems supplying wye-delta or delta-wye connected transformers (having the wye neutral point in the primary ungrounded or not connected to the circuit) the authority enforcing this code may require that three running overcurrent units be provided for the protection of three-phase three-wire motors, if field experience in the territory of the authority indicates that a third unit is desirable because of motor winding failures at times of primary single-phase failures, unless the motors are otherwise adequately protected."

Mandatary fuse rule

It will be noticed that the note itself says that the enforcement authority *may* require three overcurrent units including one in the

Code test questions

1. Where fuses are used for motor-running protection, a fuse shall be inserted in each of the ungrounded conductors. True or false?

2. Where a motor is connected to a branch circuit by means of an attachment cap and receptacle, the cap and receptacle shall not exceed 15 amperes at 115 volts and 10 amperes at 250 volts where individual running overcurrent protection has been omitted. True or false?

3. Motor-running protective devices which can restart a motor automatically after overcurrent tripping are intended to be interchangeable between motors of the same size, current, and voltage ratings. True or false?

4. The ratings or settings of motor-branch-circuit short-circuit and ground fault protective devices shall not exceed 125 per cent of the motor full-load running current. True or false?

5. Motor-branch-circuit overcurrent protection and motor-running overcurrent protection may be combined in a single overcurrent device when the rating or setting of the device provides 125 per cent of the motor full-load current on motors marked to have a temperature rise of not over 40 C and on sealed (hermetic-type) refrigeration compressor motors and 115 per cent on all other motors. True or false?

6. Motor-running overcurrent devices other than fuses shall have a rating not less than:
(a) 115 per cent of the motor full-load current rating.
(b) 125 per cent of the motor full-load current rating.
(c) 150 per cent of the motor full-load current rating.
Which is correct? a? b? or c

7. Thermal cutouts which are used as motor-running overcurrent (overload) protection but which are not capable of opening short-circuits shall be protected by:
(a) fuses.
(b) circuit breakers.
(c) fuses or circuit breakers.
Which is correct? a? b? or c

8. A circuit breaker which is used for branch-circuit short-circuit and ground fault protection shall have a continuous current rating of not less than:
(a) 115 per cent of the motor full-load current rating.
(b) 125 per cent of the motor full-load current rating.
(c) 150 per cent of the motor full-load current rating.
Which is correct? a? b? or c

9. Where a tap is made to a motor feeder, reducing the size of the conductors in an inaccessible location:
(a) the "10-foot rule" only may be applied in locating the motor overcurrent device.
(b) the "25-foot rule" only may be applied in locating the motor overcurrent device.
(c) either the "10-foot rule" or the "25-foot rule" may be applied in locating the motor overcurrent device.
Which is correct? a? b? or c

10. The maximum size permitted for a motor feeder short-circuit and ground fault protection device is determined by:
(a) obtaining the sum of all the full-load running currents of all the motors connected to the feeder.
(b) adding to the size of the branch-circuit protective device of the largest motor, the sum of all the remaining motors connected to the feeder.
(c) computing 125 per cent of the full-load running currents of all the motors connected to the feeder.
Which is correct? a? b? or c

Correct answers may be found at end of article on page 115.

grounded conductor where one phase is grounded depending upon field experience in the area. But where *fuses* are used for the motor-running overcurrent devices, Section 430-36 states that a fuse *shall* be placed in the grounded conductor under the conditions described in the note.

Fuses are not often used nowadays for motor-running protection, since many small motors have protective devices integral with the motors and most large motors are protected by overcurrent devices which are in the same enclosures with the motor controllers.

However, fuses may be, and at times are, used for this purpose. Only the time-delay type is suitable for this use, since motor-running protective devices cannot exceed 125 per cent of the motor-running current for most continuous duty motors and not more than 115 per cent for other motors. (Fuses which can be replaced by fuses of a higher rating should never be used for motor-running protection.)

The conditions set forth in the note following Table 430-37 and the reasons for the extra protection needed were explained in this department in an earlier issue. It is not amiss, however, briefly to explain this condition again for the convenience of readers who may have missed seeing it before.

When one phase of the primary is open in either a wye-delta or delta-wye system in which the primary is either not grounded or the ground is not connected to the circuit, the resulting currents in the secondary will increase to 230 per cent above normal in one conductor while in the other two conductors, the current will increase to only 115 per cent of normal. See Figure 1.

If the phase having 230 per cent happens to be the phase without overcurrent protection, the overcurrent devices in the other two phases are not likely to operate. The result will be a burned out winding and possibly a fire in the building. (If the system is connected wye-delta with one phase of the secondary delta grounded, the control circuits should be connected between the ungrounded phases only).

Overcurrent device rule

Table 430-37 lists the minimum number of motor-running overcurrent devices permitted when devices other than fuses are used. In general, these minimum requirements list two devices for two-phase and for three-phase motors and one device for single-phase a-c motors and for d-c motors.

Motor-running overcurrent protective devices which are not capable of safely opening short-circuits, are required by Section 430-40 to be protected by fuses or circuit breakers which are rated or set at not more than 400 per cent of the motor full-load current.

Motor-running overcurrent devices, other than fuses, are required by Section 430-41 to have a rating or setting of not less than 115 per cent of the motor full-load current. It will be remembered that the *maximum* rating or setting permitted for motor-running overcurrent devices by Section 430-32 is 125 per cent of the motor full-load current for sealed hermetic-type refrigerator compressor motors and for other motors rated at not over 40 C, and 115 per cent for all other motors.

Two or more motors which are not permanently installed are permitted by Section 430-42, and by its references to Sections 430-32 and 430-53, to be connected to the same branch circuit without individual motor-running overcurrent protection provided that each motor is within sight of the controller and each motor does not exceed 1 horsepower or 6 amperes.

Where larger motors are connected to a general purpose branch circuit, the motor-running overcurrent devices and the controllers are required to be ". . . approved for group installations with the protective device of the branch circuit to which the motor is connected."

Most motor-running overcurrent protective devices are of the manually reset type. Some, however, are of the automatically reset type. Automatic restarting which could result in injury to persons is prohibited by Section 430-43. In addition, this section requires that motor-running overcurrent devices of the automatic restarting type, if used, be ". . . approved for use with the motor which it protects."

Branch-circuit protection

As distinct from motor-running overcurrent (overload) protection, motor branch-circuit short-circuit and ground fault protection, which is frequently referred to also simply as motor branch-circuit protection, is designed to protect the motor and its conductors and control equipment against overcurrents resulting from short-circuits or ground faults.

Some of the rules in Article 430 governing such protective devices seem at variance with the rules in Article 240 on overcurrent devices because high momentary motor starting currents sometimes require sizes larger than "normal" in some types of overcurrent devices. That is why Section 430-51 states that the rules in Article 430 ". . . are in addition to or amendatory of the provisions of Article 240."

This excess in size, however, can be held to a much smaller margin in most cases if care is exercised in the selection of such overcurrent devices. Circuit breakers and time-delay fuses which are designed for motor circuits usually give better results than overcurrent devices which are not provided with slight time delays for moderately high inrushes of current.

Time delay devices act instantaneously on heavy inrushes of current which result from short-circuits or ground faults, but have slight delays for minor current inrushes such as that resulting from motor starting.

Overcurrent devices without the time delay feature, if used on motor circuits, must be larger in size to allow for starting currents, and therefore they provide less pro-

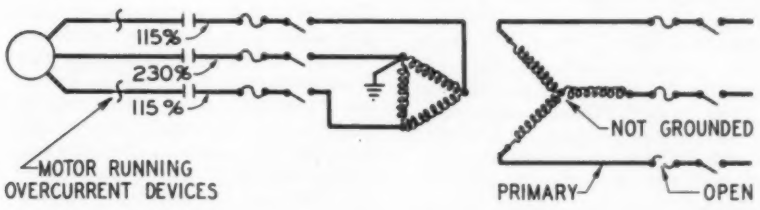


Fig. 1—Under conditions illustrated, the inspector may require three motor-running overcurrent devices. If fuses are used as the motor-running overcurrent devices, three are definitely required under these conditions. With one primary open on an ungrounded primary system, the current in secondary will be 115% of normal in two phases and 230% of normal in one phase. If no overcurrent device is in the phase with 230% current, motor will burn out.

tection after the motors reach the running position. In any case, as stated in Section 430-52, "The motor-branch-circuit overcurrent device shall be capable of carrying the starting current of the motor."

Tables 430-52 and 430-53 list the maximum ratings or settings for motor branch-circuit short-circuit and ground fault protective devices for various types of motors marked with code letters and without code letters, respectively. Section 430-52 permits such settings or ratings to be increased to 400 per cent of the motor full-load running currents ". . . where the overcurrent protection specified in the Tables is not sufficient for the starting current of the motor . . ." As stated above, however, discriminate selection will permit the use of overcurrent devices well within the specified limits.

Columns 4, 5, 6, and 7 in Table 430-146 lists sizes of overcurrent devices based on the percentages listed in Tables 430-152 and 430-153. (Column 1 lists the motor full-load running currents which are obtained from Tables 430-147 through 430-150, and columns 2 and 3 list the maximum ratings or settings of motor running overload protective devices.)

Group protection

The Code requires motor branch-circuit protective devices on each separate motor except under the restricted conditions listed in Section 430-53. These conditions may be divided into two groups. Group one consists of small motors, and group two consists of any size motors.

In group one, two or more motors may be connected to a single branch circuit provide that: (1) each motor so connected does not exceed 1 horsepower or a full-load running current of 6 ampers; (2) the branch circuit to which the motors are connected is protected by an overcurrent device not exceeding 20 ampers at 125 volts or less, or 15 amperes at 600 volts or less; (3) each motor so connected is provided with a motor-running overcurrent (overload) protective device. The overcurrent device may be omitted from any such motor which complies with all of the following three conditions: (1) It is manually started; (2) it is within sight of the controller; and (3) it is not permanently installed.

In group 2, two or more motors of *any* rating may be connected to a single branch circuit provided that *all* of the following conditions

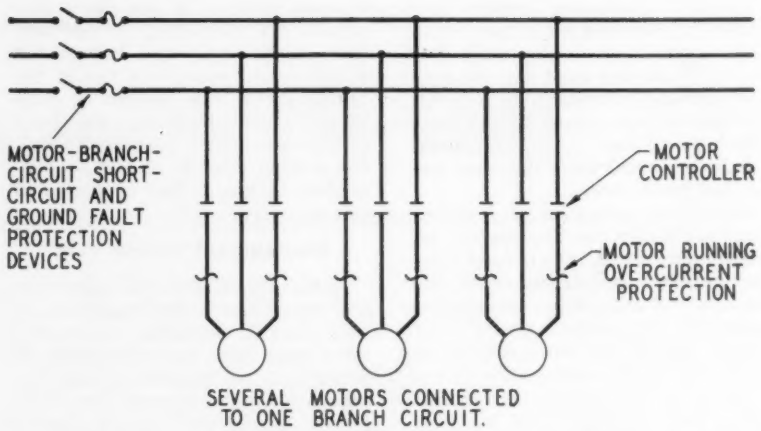

MOTOR-BRANCH-CIRCUIT SHORT-CIRCUIT AND GROUND FAULT PROTECTION DEVICES
MOTOR CONTROLLER
MOTOR RUNNING OVERCURRENT PROTECTION
SEVERAL MOTORS CONNECTED TO ONE BRANCH CIRCUIT.

Fig. 2—Fuses or circuit breakers in motor branch circuit must be large enough to start largest motor while all other motors are running and yet not exceed 400% of running current of smallest motor or maximum marking on motor-running overcurrent devices. Motor controllers must be approved for group operation. Motor-running overcurrent devices must be approved for group operation and marked for maximum size fuse or circuit breaker which may be used to protect it. If branch circuit fuse or circuit breaker exceeds this marking or 400% of running current of smallest motor, then individual branch circuit devices must be used.

are met: (1) Each motor is provided with a motor-running overcurrent (overload) protective device which is approved for group installation; (2) each motor is provided with a controller which is approved for group installation; and (3) the branch circuit to which the motors are connected is provided with a branch-circuit short-circuit ground fault protective device which is large enough to start the largest motor in the group while all of the other motors in the group are running and yet (a) not exceed 400 per cent of the full-load running-current of the smallest motor in the group, or (b) not exceed the maximum size fuse marked on the motor-running overcurrent device as suitable for branch-circuit protection. See Figure 2.

In addition to the above restricted uses, the conductors of a tap supplying a single motor are not required to have individual branch-circuit protection where such conductors have a carrying capacity (1) at least equal to that of the branch-circuit conductors; or (2) at least equal to 1/3 that of the branch-circuit conductors, are not over 25 feet in length, are protected from mechanical injury, and have a carrying capacity at least equal to 125 per cent of the motor full-load running current.

Except for motors of 1 horsepower or less or 6 amperes or less, motors installed for group installations are required by Section 430-53(b) (3) to be protected by fuses. No provision is made for circuit breakers. This reference to fuses only is unintentional and not intended to exclude the use of circuit breakers for this purpose. Evidence of the intent to include circuit breakers may be found in Section 430-40 which states that motor-running protective devices which are not capable of opening short-circuits ". . . shall be protected by fuses or circuit-breakers. . ." (This section also has a final reference to fuses, but by the above quoted part of the section, the intent to include circuit breakers is established.)

Where fuses are used for branch-circuit protection which are not of the time-delay type, the fuse-holders installed are required by Section 430-56 to be not smaller than would be necessary to accommodate the fuses listed in Table 430-146. If time-delay fuses are used, however, the exception to this section permits smaller size fuse-holders to be installed. But in no case may the disconnecting switch (which usually is also the fuse-holder) have a horsepower rating smaller than the horsepower rating of the motor itself for motors of over two horsepower up to and including 50 horsepower.

A circuit breaker which is used for motor branch-circuit protection is required by Section 430-57 to ". . . have a continuous current rating of not less than 115 per cent

of the full-load current rating of the motor."

Section 430-58 permits the "25 foot rule" but not the "10 foot rule" where taps are made to motor feeders. It states, "If the location of a connection of a tap to the feeder conductors is not accessible, the motor-branch-circuit overcurrent device may be placed where it will be accessible, provided the conductors between the tap and the overcurrent device have the same current-carrying capacity as the feeders; or provided they have a current-carrying capacity of at least 1/3 that of the feeder and are not more than 25 feet long and are protected from physical damage."

The maximum size of the short-circuit and ground fault protection which is permitted for a motor feeder supplying several motors is determined by adding to the size of the branch-circuit protection for the largest motor the sum of the full-load running currents of all the other motors connected to the feeder. Or, for large oversize feeders installed for future motor loads, the feeder short-circuit protection may be based on the feeder current-carrying capacity.

We will begin next month's discussion with motor-control circuits.

Answers to Code test questions: (1. **T** Section 430-36) (2. **T** Section 430-42-c) (3. **F** Section 430-43) (4. **F** Section 430-52) (5. **T** Section 430-54) (6. **a** Section 430-41) (7. **c** Section 430-40) (8. **a** Section 430-57) (9. **b** Section 430-58) (10. **b** Section 430-62).

Questions on the Code

(Readers are invited to send in questions which they would like to see discussed in this department.)

Conduit expansion fitting requirements

QUESTION: We manufacture a line of conduit expansion fittings. One of the purposes of these fittings is to compensate for expansion and contraction in long runs of rigid conduit caused by temperature changes. Have there been any changes set up for steel and aluminum conduit which states the requirement of expansion fittings per stated number of feet of conduit per stated number of degrees temperature change? I have examined the 1959 National Electrical Code and read Paragraph 300-6 which refers to this situation but does not give any definitive answer.

ANSWER: The Code has not set any specific distance for expansion joints in raceways for varying temperatures and conditions. This must be determined by the inspector. The same thing is true in regard to the location of pull or junction boxes and to the number of straps or supports for raceways.

In addition to the fine print note following Section 300-6 which states, "Consideration should be given to expansion and contraction of runs of conduit from temperature changes.", Section 250-76 has definite requirements. This section states, "Loosely-Jointed Metal Raceways. Expansion joints and telescoping sections of raceways shall be made electrically continuous by bonding jumpers or other approved means . . . ." Therefore, although the actual placement of expansion joints is not specified by the Code, all such joints are definitely required by the Code to be made electrically continuous.

It is the usual practice to install expansion joints at all locations where the structure itself has expansion joints and in long runs where expansion and contraction are likely to exist. The electrical contractor must use his judgement in this respect; and, of course, the local inspection authority has the final and decisive say in such matters.

Non-combustible slabs for motor resistors

QUESTION: It is not clear to me what the Code size requirements are for noncombustible slabs on which wound-rotor resistors are to be mounted when near combustible material.

ANSWER: The Code does not specify such size requirements other than stating a minimum size and stating that it must be of sufficient thickness to support the weight. Section 470-3(b) states, "The slab shall extend beyond the edges of the device and shall have a thickness proportioned to the size and weight of the device but shall not be less than ½-inch thick."

It is necessary, therefore, to furnish the dimensions and the weight of the resistor to the supplier of the slab in order that a slab of sufficient strength may be supplied. If it is possible to get a clearance of not less than 1 foot from the combustible material, such a slab is not required by the Code. See Section 470-2.

Grounding of metal box in contact with metal

QUESTION: I would appreciate some comments on Article 250, section 42, Equipment Grounding. The Code states that *exposed* non-current-carrying metal parts and related equipment are to be grounded. Numerous inspectors and contractors contend that 250-42 does not require grounding boxes used with non-metallic sheathed cable installed in contact with metal lath or conductive thermal insulation where a bakelite plate is used.

What if the next family should desire to use chromium or brass plates near grounded surfaces? We inspectors know that a hazard would exist if a box was grounded and energized the metal lath in an entire room regardless of the plate used. I feel as if numerous inspectors and contractors would enjoy reading such a discussion in the ELECTRICAL SOUTH.

ANSWER: The word *exposed* as used in Section 250-42 in relation to non-current-carrying parts is not used necessarily to indicate equipment which is out in the open. In a case such as you referred to, it means equipment without insulation. The definition of *exposed* in Article 100 includes several meanings. One of these as applied to live parts states, " . . . It is applied to parts not suitably guarded, isolated, or insulated."

When reference is made to "exposed" non-current-carrying metal parts in contact with metal lath or metal insulation, it is generally understood to mean bare metal boxes in contact with such lath or insulation, and it is generally understood that both will be covered and be out of reach. Section 250-42(f) intends that whether covered with metal or insulated plates, such boxes in such cases are to be grounded.

Furthermore, Section 370-4 states, "Metallic Boxes. Where used with knob-and-tube or non-metallic sheathed cable, and mounted on metal or metal lath ceilings or walls, such boxes shall be insulated from their supports and from the metal or metal lath, or shall be grounded." There is no mention in this section of the word *exposed*, it just says metal boxes; and it is quite definite. Certainly, it is much easier to ground the boxes than to insulate them from their supports and from the lath or metallic insulation.

News of the industry

edited for Southern readers

Electric house heating meeting set for 1962

THE SECOND National Electric House Heating Symposium and Exposition, an expanded version of the highly successful 1960 program, will be held March 19-21, 1962, in the Sherman Hotel, Chicago, Ill., it is announced by the sponsoring organization, the Electric House Heating Equipment Section of the National Electrical Manufacturers Assn.

Announcement of the next Symposium and Exposition is made at this time because of some reports that it might be held in 1961. Members of the NEMA Section considered this possibility immediately after the 1960 event, but concluded that time was too short to plan the type of program requested by the 3,000 people who attended the first program.

Sponsoring manufacturers stated that the 1962 Symposium and Exposition will emphasize and detail such electric house heating specifics as the proper installation of equipment, requirements and installation techniques of various types of insulation materials, electric house heating for both new and remodeled homes, and case histories on the use of electric heat and its advantages over other methods of heating. The program also will feature a review of effective electric heating promotions.

Heat pump companies urged to standardize

ELECTRIC HEAT pump manufacturers are being urged to adopt and comply with uniform rating standards by the General Sales Section of the Southeastern Electric Exchange.

A resolution citing the need for comparable heat pump ratings by the various manufacturers was adopted by the SEE sales group July 14 at a special meeting in Atlanta, Ga. The action was taken at the recommendation of the SEE Heat Pump Task Force Committee which previously had conferred with representatives of several manufacturers on heat pump sales and service problems.

Manufacturers were asked to support the efforts of the American Refrigeration Institute in "the early development of standards for the package central system heat pump and compliance with such standards as a means of uniformity of the manufacturers' rating methods and performance. We believe this is necessary to the rapid and orderly development, use and acceptance of the electric heat pump in the Southeast."

Night light service provided by utility

A NEW all-night, automatic outdoor lighting service, called "The Nightwatcher," is now available to the customers of Arkansas Power & Light Co.

Operated by a photo-electric cell, the "Nightwatcher" lighting unit will be installed, owned, operated, and maintained by the power company. For this service, the customer will pay $3.00 per month in most cases.

"The Nightwatcher" unit is similar in appearance to many types of overhead street lighting units. The enclosed luminaire is designed to utilize a long-life 300-watt street lighting lamp. The power company will replace burned-out lamps and otherwise keep the "Nightwatcher" units in working order at no additional charge to the customer.

"This new dusk-to-dawn lighting service will enable the homes, farms, businesses and industries served by the power company to enjoy low cost nighttime protection and convenience," said AP and L Vice-President W. M. Shepherd.

Subdivision sets all-electric record

NINETY-SEVEN per cent of the new homeowners in the Mark Twain housing subdivision, of St. Charles, Mo., have chosen Westinghouse Total Electric Homes, making this the largest concentration of residential electric heating in the state, it was announced recently.

Gene Yust, sales director of the Mark Twain Development Co., reported that all of the 154 homes have already been sold in the first subdivision, and that all owners have been given their choice of electric heating or conventional fuels.

As a result of the demonstrated preference for electric heating, Mr.

ELECTRICAL EQUIPMENT ON TOUR—A series of station wagons outfitted with the latest products from the Square D Company are currently touring the country, giving electrical contractors a first-hand view of new developments. Here, Vance Young, Square D field engineer, demonstrates a QMB panelboard to a group of electrical contractors. Other station wagons are demonstrating motor control and specialized industrial controls. Reaction has been so favorable that Square D plans to keep the fleet in the field.

Yust said, the Mark Twain Company is planning another subdivision of 650 Total Electric Gold Medallion Homes which will adjoin the original tract.

He explained that the Total Electric Homes use electricity exclusively for lighting, heating, cooling, entertaining, preparing and preserving food, and performing all of the labor-saving services of modern living.

A survey of residents in the project brought forth many comments on the advantages of electric heating. Typical remarks were: "even and convenient," "no draft, no hot blast," "cleaner—no colds in the family," "seldom required to dust, no dirt," and "no allergy problems now."

Palmetto distributor changes ownership

DAVID K. HOLLIDAY became new president of the Palmetto Electric Supply Co., of Columbia, S. C., recently following purchase of the entire outstanding capital stock by a group engaged in the electrical distribution business for a number of years.

Other new officers include James E. Goddard, Jr., vice-president and treasurer; Jesse W. Grahl, vice-president; Vance L. Yount, vice-president; and Marvin B. Layton, secretary.

F. Jack Seastrunk was formerly president and owner of the business, which has represented many major manufacturers of electrical equipment for more than 25 years. The company serves electrical contractors, utilities, city and state departments, rural electric cooperatives, and industrial establishments, covering the central and eastern portions of South Carolina.

Mr. Holliday served Palmetto Electric as vice-president and general manager from 1936 until he became president recently.

Dates ahead

Illuminating Engineering Society, National Technical Conference, Penn-Sheraton Hotel, Pittsburgh, Pa., Sept. 11-16, 1960.

National Rural Electric Cooperative Assn., Region VIII, Annual Meeting, Motel Arlington, Hot Springs, Ark., Sept. 12-13, 1960.

National Rural Electric Cooperative Assn., Region 11, Annual Meeting, Kentucky Hotel, Louisville, Ky., Sept. 15-16, 1960.

Public Utilities Association of the Virginias, 42nd Annual Meeting, The Greenbrier, White Sulphur Springs, W. Va., Sept. 15-17, 1960.

Missouri Valley Electric Assn., Accounting Conference, President Hotel, Kansas City, Mo., Sept. 22-23, 1960.

Southeastern Electric Exchange, Accounting Conference, Tides Hotel, St. Petersburg, Fla., Sept. 29-30, 1960.

International Association of Electrical Leagues, 25th Annual Conference, President Hotel, Kansas City, Mo., Oct. 5-7, 1960.

American Institute of Electrical Engineers, Fall General Meeting, Chicago, Ill., Oct. 9-14, 1960.

National Rural Electric Cooperative Assn., Region II, Annual Meeting, Henry Grady Hotel, Atlanta, Ga., Oct. 10-11, 1960.

Florida Assn. of Electrical Contractors, Annual Convention and Electric Show, Deauville Hotel, Miami Beach, Fla., Oct. 12-15, 1960.

National Rural Electric Cooperative Assn., Region IV, Annual Meeting, Stonewall Jackson Hotel, Clarksburg, W. Va., Oct. 13-14, 1960.

National Rural Electric Cooperative Assn., Region X, Annual Meeting, Baker Hotel, Dallas, Texas, Oct. 17-18, 1960.

IAEI, Southern Section, Rice Hotel, Houston, Texas, Oct. 17-19, 1960.

Southeastern Electric Exchange, Engineering and Operation Section Conference, Shoreham Hotel, Washington, D. C., Oct. 20-21, 1960.

Power Industry Computer Application, 2nd National Conference, Chase Hotel, St. Louis, Mo., Nov. 9-11, 1960.

Southeastern Electric Exchange, Sales Conference, Henry Grady Hotel, Atlanta, Ga., Nov. 16-18, 1960.

Missouri Valley Electric Assn., Industrial and Commercial Sales Conference, President Hotel, Kansas City, Mo., Feb. 9-10, 1961.

Missouri Valley Electric Assn., Engineering Conference, President Hotel and Municipal Auditorium, Kansas City, Mo., April 12-14, 1961.

Edwards institutes new pricing system

A NEW SIMPLIFIED unit pricing program to save distributors time and money was recently put into effect by the Edwards Co., Inc., Norwalk, Conn.

The SUP program features simplified discounting, revised and precalculated price lists, machine-controlled invoicing, packaging geared to shelf movement, and prepaid shipping.

All Edwards products now fall into just two categories. Class I Covers stock items and some components. Systems fall into Class II. In addition, full distributor discounts will be extended to many additional Edwards products, at no increase in list price.

Price lists have been revised, and are now color-coded. Also, all necessary ordering information now takes up a single line. List, contractor-dealer net, distributor costs, and unit prices have all been pre-calculated to speed distributor transactions.

Electronic data processing systems are a part of the new SUP program, and invoices now automatically follow shipments.

New packaging is also in effect, with fast-moving items packed in multiple, while special or slow-moving products are packaged singly.

New shipping policies of the plan call for Edwards to pay all transportation costs within the Continental United States on all orders above $200. In the event of incorrect shipment, the company pays distributors a 5 per cent bonus.

G-E stages fall push for light bulb sales

GENERAL ELECTRIC has announced a fall million dollar light bulb sales push built around what it calls "The five point point-of-purchase selling system."

The "five-point" system refers to a marketing approach which calls for activities in five key areas—product, package, merchandisers, display, and advertising—all culminating at the point of purchase.

Important innovations in each of these areas, of benefit to both purchaser and retailer, will be featured in the intensive fall bulb-selling program, according to Robert V. Corning, G-E Large Lamp Department marketing manager.

"Over the years," Mr. Corning said, "the lighting industry has conducted many sales activities based on exploiting a single feature, such as a new package or an improved product. Our new activity, however, employs a broad approach which recognizes that many marketing elements are important to both customer and retailer."

Corning said the fall promotion, which gets underway the week of September 19, represents a greatly expanded and improved follow-up to a campaign in the spring.

"This was the most successful such activity in the entire history of the G-E Large Lamp Department," Mr. Corning said.

He credited much of the success of the promotion to a novel local TV spot commercial campaign featuring the nearsighted Mister Magoo, and to successful retailer tie-in activities and displays. This phase of the promotion will be continued in the fall, with Magoo as a political candidate under the campaign slogan, "Vote for Magoo—and G-E Bulbs Too!"

Conference to explore digital computer uses

HIGHLIGHTING the meeting theme, "Computers for Engineering and Power," will be two featured speakers at the second Power Industry Computer Application Conference on November 9-11, 1960, at the Chase Hotel, St. Louis. J. W. McAfee, president of Union Electric Co., and M. W. Humphrey Davies, professor of Electrical Engineering, Queen Mary College, University of London, will be luncheon speakers during the meeting.

F. J. Maginniss will serve as conference chairman and Dr. E. L. Harder as program chairman of the 2nd Power Industry Computer Application Conference, in St. Louis, sponsored by AIEE.

Latest developments in digital computers for utility engineering and plant automation will be presented in 25 papers by authors from operating utility companies, electrical manufacturers and universities, both in this country and abroad. The conference is co-sponsored by the Power Division and computing Devices Committee of the American Institute of Electrical Engineers.

A special feature of this second meeting will be an afternoon and evening for discussion groups to talk over specific areas of interest in engineering or control.

General sessions at the conference will be devoted to: (1) power system analysis by digital computer; (2) computers for system operation and optimizing; (3) computers for system planning; and (4) automation and data gathering—computer control.

Gibson products get distinctive recognition

FLUORESCENT lighting fixtures manufactured by Gibson Manufacturing Co., Atlanta, Ga., headed by Richard R. Gibson, have achieved special recognition recently from two sources. One series of C77 units equipped with the "Canopy Uni-Race" have been listed by Underwriters Laboratories for direct mounting on low density ceilings and have the distinction of being the first fluorescent fixture approved for this type application. The fixture is part of the Ortho-77 line designed for individual or continuous row mounting.

Gibson's new Ortho-77 troffer was selected by the National Progress Committee of the Illuminating Engineering Society as having made the greatest contribution to the art and science of lighting in its category for the year 1960 and will be shown at the IES National Technical Conference in Pittsburgh.

Bulova to manufacture radiant heat controls

THE ENTRY of Bulova Watch Company into the field of automatic control of electric radiant heating was announced recently.

Harry B. Henshel, Bulova president, said American Time Products, Inc., a wholly-owned subsidiary, has acquired exclusive rights to produce and market a line of precision automatic radiant heating controls developed by the Harry Alfred Mulvany Laboratory, of Berkeley, Calif.

The new thermostats will be manufactured at American Time Products' plant in Woodside, N. Y. under the direction of J. N. Heed, president.

"American Time Products' skills used in producing temperature-sensitive metals for tuning forks and other devices, plus Bulova's long experience in electronics, are readily adaptable to the development and production of this new type of radiant heating control instrument," Mr. Henshel said.

The thermostats, he explained, operate on new principles of temperature sensing. They respond primarily to radiant heat energy as supplied by the electric radiant heating units in addition to the effects of sunlight and changes in air temperature.

Day-Brite names Whitehead president

JAMES F. WHITEHEAD, JR. was elected president of Day-Brite Lighting, Inc., recently as the company formally joined forces with Emerson Electric Manufacturing Co., St. Louis. Day-Brite became a subsidiary of Emerson Electric under the terms of a transaction involving the exchange of Emerson common stock for the assets of Day-Brite. The action had previously been approved by both companies.

Mr. Whitehead, executive vice president since 1956, succeeded O. W.

James F. Whitehead

Klingsick as president of Day-Brite. Mr. Klingsick became vice chairman of Day-Brite's board of directors, with D. J. Biller continuing as chairman of the board.

A native of Athens, Ga., Mr. Whitehead was educated at Georgia Tech. Before joining Day-Brite in 1945 as a factory representative he was district superintendent and architectural lighting specialist for the Georgia Power Co. During World War II he was loaned to Robert & Company to design the lighting installation for the Bell bomber plant at Marietta, one of the largest installations in the world. He resigned his position at Georgia Power Company after 16 years service to accept the Day-Brite appointment.

In 1948, Mr. Whitehead moved his family to St. Louis to accept the assignment as general sales manager of Day-Brite. In 1953, he was elevated

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16" x 1 1/16" x 7/8", Outlet 8" center

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Evans Roof Flanges provide lifelong leakproof protection and meet any building specification. A choice of three metals—galvanized, aluminum, and cast lead are manufactured to meet every requirement.

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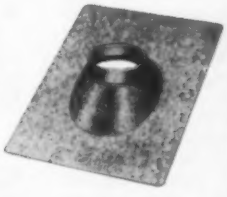

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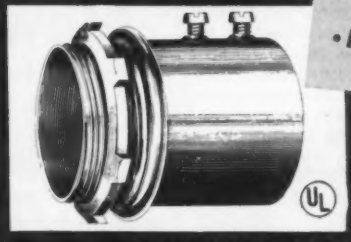

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Texas & Okla.: Brenner Elect., Box 51, Houston.
N.C., S.C. & Va.: Robert Wintrie, Box 1744, Annapolis, Md.
Miss. & La.: F. C. Baldridge Co., 302 Eureka Bldg., New Orleans 12.

to vice president in charge of the marketing and engineering activities of the company. He was elected a director of the company in 1955 and became executive vice president the following year.

Anchor appoints middle-South rep

GREGORY-SALISBURY & Co., Inc., with headquarters at 820 Julia Street, New Orleans, has been appointed manufacturers' representative for Anchor Manufacturing Company's meter mounting and service equipment line.

Thirteen electrical and sales engineers work out of five well staffed regional offices in New Orleans, La., Baton Rouge, La., Jackson, Miss., Memphis, Tenn., and Little Rock, Ark., to serve the middle South.

Gregory-Salisbury & Co., Inc., succeed E. W. Cook of Jackson, Miss., who recently retired.

REB announces opening of new branch office

REB ASSOCIATES, INC., of Miami, representatives of Lithonia Lighting Products Co., Pfaff and Kendall, and Hope Electric Products Co., announce the opening of their new branch office at 308 Tampa St., Room 324, Tampa, Fla.

Jack E. Mason, formerly with Raybro Electric Supplies, Inc., will head the branch as vice-president.

Thomas Industries forms integral sales force

THOMAS INDUSTRIES, INC., Louisville, Ky., manufacturer of lighting fixtures, has announced that it has reorganized its sales forces to form "the first wholly integrated merchandising and sales engineering service for residential, commercial, and industrial lighting fixtures."

Thomas R. Fuller, vice-president, general sales, explained the new sales organization is made up of two groups of men:

"First, what we have chosen to call merchandising salesmen will sell all lighting fixture products and work with distributors, contractors, home builders and other users to stimulate promotional programs, stocking programs, and merchandising activities.

"Secondly, a special corps of lighting sales engineers will provide technical information and assistance to architects, electrical contractors and specifying engineers in an effort to stimulate and expedite work from the technical side."

The new-set-up, which includes more than 100 men divided into 12 geographic divisions, eliminates the old division of sales responsibilities along product lines, Fuller said.

"Previously, residential lighting fixtures, including the Moe, Enchante' and Star Light lines manufactured by the Moe Light division, and the commercial and industrial fixtures manufactured by the Benjamin division, were handled by two entirely separate sales groups."

Brief news notes of manufacturers

JASPER BLACKBURN Corporation has begun construction on a 10,000 square foot addition to its present 100,000 square foot St. Louis plant. The project, scheduled for September completion, will expand manufacturing and warehousing facilities.

* * *

CHARLES WENNER, president of the James R. Kearney Corp., St. Louis, and John R. Morrill, president of Hubbard and Co., Chicago, jointly announce the consolidation of the Electrical Engineers Equipment Division and the James R. Kearney Corp. The amalgamation of the two lines provides the industry with a major single source of outdoor and indoor switching devices.

This latest change is one of a series of steps by Hubbard and Kearney to combine efforts in the fields of engineering, manufacturing and marketing of products for the electrical transmission and distribution industry.

* * *

OVER $500,000 is being spent by Preformed Line Products Company to expand manufacturing and office space at its Cleveland, Ohio, headquarters. Acquisition of two three-story buildings occupied by Ohio Piston Company and Standard Pattern Works, which are adjacent to Preformed's main plant at 5349 St. Clair Ave., almost doubles the company's present production capacity, according to T. F. Peterson, Jr., vice-president-manufacturing.

* * *

PLANS for the construction of a new $750,000 manufacturing plant in DeKalb County, near Atlanta, Ga., were announced by John G. Detwiler, president of Central Cable Corp., Jersey Shore, Pa. The plant will manufacture a complete line of aluminum and copper conductors for sale to utilities and for other purposes. Construction of the first unit of the new industrial plant, a 34,000-square-foot building, will begin within the next 30 days and is expected to be in operation by the end of 1960. This unit will serve the southeastern and southwestern part of the United States.

* * *

WHEATLAND ELECTRIC Products Company executives and office staff recently occupied office quarters for the first time in their newly constructed plant-office building at 500 Logan Street, Carnegie, Pa., part of an eight-acre industrial park site.

Equipment and production facilities for the manufacture of underfloor raceway systems and the various assembly operations occupies nearly 16,000 sq. feet. Production of electrical conduits will continue at the Wheatland, Pa., plant.

Wheatland's new one-story factory is one of the largest in the nation to be erected entirely of pre-cast concrete slab panels which fit into prefabricated pillars.

News about people

The firm of Dupont-Bondurant, of New Orleans, La., has been appointed by the Carol Cable Co., a division of The Crescent Company, of Pawtucket, R. I., as its representative for Louisiana and Mississippi. Announcement of the appointment was made by **Kenneth R. MacLean,** Carol Cable's vice-president-sales.

Headed by **Eugene Bondurant** and **Lawrence Dupont,** the firm has its headquarters at 717 Jefferson Highway, New Orleans.

The Williams and McKinley Sales Co., 1344 Wilton Lane, Kirkwood 22, Mo., has been appointed sales representative for Subox, Inc., to cover eastern Missouri and greater St. Louis, it was announced recently by **H. S. Bennett,** of Subox.

In Kansas City, western Missouri, and Kansas, another branch of the agency, located at 417 Grand Ave., Kansas City, will serve Subox.

Southern States recently promoted **Roy N. McCowen** to Southwest regional manager and **Bruce Smith** to district manager. Mr. McCowen was formerly district manager, while Mr. Smith held the position of sales engineer. Both men will continue operating from Southern States field office in Dallas, Texas.

Robert H. Hanson, 159 Cane St., N.W. Atlanta, Ga., has been appoint-

ed new district sales manager by the Wadsworth Electric Mfg. Co., Inc. Mr. Hanson has been associated with electrical manufacturers, distributors, engineers, and contractors for a number of years prior to his new position.

He is replacing **George H. Will, Jr.,** who resigned to enter the sales management field of the electrical heating industry.

Lawrence A. Navarro was recently promoted by Line Material Industries to the newly created position of manager of sales training. Formerly L-M's technical editor, Mr. Navarro will now plan and participate in the training of newly employed sales

Lawrence A. Navarro

personnel, and develop sales training programs and methods for the company's field and branch organization.

Before joining L-M in 1953, Mr. Navarro was a technical writer for Sperry Gyroscope Company and Minneapolis-Honeywell Co. A graduate of the University of North Dakota, he received his electrical engineering degree in 1950.

Clifford E. Shaw, formerly a technical writer for L-M, has assumed the vacated technical editor position. Mr. Shaw has been with Line Material since 1956 when he joined the technical editing department. He holds an electrical engineering degree from Colorado State University. He was graduated in 1950.

R. A. Millermaster, Cutler-Hammer vice-president - development, was recently elected to the Milwaukee electrical firm's board of directors, **Philip Ryan,** president of the firm announced.

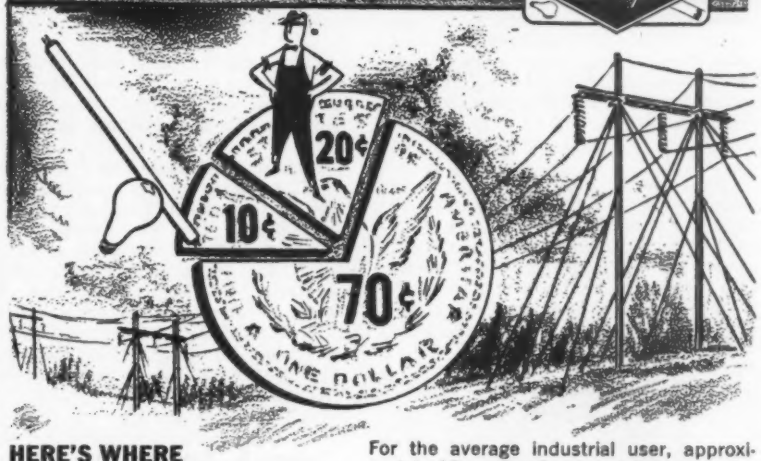
Mr. Millermaster joined Cutler-Hammer as a test engineer following his graduation in 1927 from the University of Wisconsin.

Appointment of two new sales representatives for Virden Lighting has been announced by **Vernon L. Wrye,** sales manager for the company.

Names to serve in eastern North Carolina, South Carolina, and north-

Facts of Light!

CHAMPION Lamps



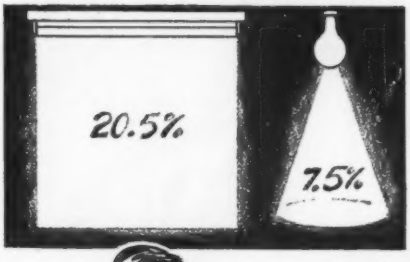
HERE'S WHERE THE MONEY GOES WHEN YOU BUY LIGHT

For the average industrial user, approximately 10 cents of every dollar spent for light goes for lamps; approximately 20 cents goes for maintenance labor; and about 70 cents goes for electric power.

2 100's WON'T DO THE WORK OF 1 200

A 200 watt incandescent lamp produces approximately 3800 lumens. Two 100 watt incandescent lamps produce approximately 3400 lumens — about 10% less light.

WATT FOR WATT, FLUORESCENTS PRODUCE TWICE AS MUCH LIGHT AS INCANDESCENTS



About 7.5% of the electrical energy consumed by a typical 40 watt incandescent lamp is produced as light. In a typical 40 watt fluorescent lamp, the percentage is about 20.5. In both types, the remainder of the electrical energy is heat loss.

OVER 200 INSPECTIONS GUARD CHAMPION LAMP QUALITY

Checks and counter checks at each step of production guard the quality and uniformity of Champion lamps. Result: you get all the light you pay for when you use Champions.

CHAMPION LAMP WORKS, Lynn, Massachusetts

CHAMPION INCANDESCENT-FLUORESCENT • *YOUR BEST BUY IN LAMPS*

eastern Georgia is **Robert F. Haynes.** He has been active in the lighting fixture business for the past four years, and will be located in Columbia, S. C.

Also selected is **Edwin S. Persons,** who will serve in portions of Missouri, Illinois, Indiana, and Kentucky. Mr. Persons' experience includes that of both salesman and buyer with the company. His headquarters will be in St. Louis.

Norborne C. Auld has been named superintendent of the Oklahoma Gas and Electric Company's Eastern division, headquartered in Muskogee, following the retirement of **Charles C. Yeakley** from that position.

Mr. Auld has been with the Oklahoma company since 1925, and held

Norborne C. Auld

the position of district manager of the Ada district prior to his present appointment. He is being replaced as manager by **J. B. Lynn.**

Mr. Yeakley served for more than 40 years before his retirement, having joined the company in 1919.

Mr. Lynn joined the company in 1927, and was serving as Ada district accountant before he replaced Mr. Auld as district manager.

New Southeastern District sales manager for Pass & Seymour, Inc., of Syracuse, N. Y. is **Delbert P. Stuart,** a member of the P&S sales force for several years. He succeeds the late

Delbert P. Stuart

James C. Major, of Atlanta, Ga.

Mr. Stuart, who will promote electrical wiring devices in the Atlanta area and will supervise the Florida and Louisiana territories, is located at 2819 Fairlane Drive, Doraville, Ga.

Slater Electric and Manufacturing Company has announced the appointment of additional new agents to represent them in the Southern area.

Richard A. Esterle, 3041 Rosedale Blvd., Louisville 5, Ky., has been appointed to serve in Kentucky.

Appointed for the Virginia and North and South Carolina areas is the E. F. Lombardi Co., represented by **Gene Lombardi** and **John E. Steele** at the agency's main office, 2712 Freedom Dr., Charlotte 8, N. C., with **Joe W. Cook,** 1565 Halstead Ave., Norfolk 2, Va., in charge of the Virginia branch.

Robert S. Fremont, president of Halo Lighting Products, Inc., Chicago, has announced the addition of several new sales representatives. Among them are **William Johnson,** Memphis, Tenn.; **Al Rosenstock and Son,** Kansas City, Kan.; and **Roland Schillicutt,** Little Rock, Ark.

Joe W. Hale has joined the field sales staff of Day-Brite Lighting, Inc., as the firm's representative in the Houston, Texas area. The appointment was announced by **Raymond P. Imre, Midwest** regional sales manager of the fixture company. Mr.

Joe W. Hale

Hale is located at 7042 Sharpcrest Avenue in Houston. He replaces **N. O. Reed,** who recently retired from Day-Brite.

Prior to his new appointment, Mr. Hale was District Lamp & Lighting Specialist for General Electric Supply Co., in Houston.

David J. Anderson has been appointed branch manager of the newly established Baltimore branch of the National Electric Division of H. K. Porter Company, Inc. Since 1957 Mr. Anderson has been a sales representative in the division's Pittsburgh branch, serving for a short time as an assistant product manager for conduit sales. A native of Pittsburgh, Mr. Anderson graduated from Thiel College with a B. S. degree in economics.

Joseph B. Schaeffer has been installed as president of the St. Louis Electrical Board of Trade for the 1960-61 year of activities. Mr.

J. B. Schaeffer

Schaeffer is manager of basic projects at Sachs Electric Corp., and has been in the electrical contracting and service business for almost 20 years.

Troy A. Brown, Jr., has recently been appointed a vice-president of Raybro Electric Supplies, Tampa, Fla., and will assist **Milton O. Hollis,** executive vice-president and general manager.

Mr. Brown received an A.B. degree

Troy A. Brown, Jr.

from Harvard, then studied law at the University of North Carolina, receiving his L.L.B. in June, 1959. He first became associated with the company in 1950.

The appointment of **Thomas H. Cashin** as marketing manager for Large Lamp Products Division of Sylvania Lighting Products, Inc., has been announced by **Garlan Morse,**

vice-president and general manager of the division. Mr. Cashin is a graduate of St. Lawrence University and of the New York University Graduate School of Business. He has been associated with Sylvania since 1948.

E. Melvin Bellott has been named assistant manufacturing manager for the Westinghouse lamp division. The announcement was made by **James E. Woodall,** division manufacturing manager.

Mr. Bellott obtained a B.S. degree in electrical engineering from the University of Tennessee in 1944, and joined Westinghouse that same year. He later obtained a masters degree from Stevens Institute of Technology.

Michael N. Flynn has been appointed sales manager of the Benjamin Division of Thomas Industries Inc., Louisville, Ky., it was announced

Michael N. Flynn

recently by **Thomas Fuller,** vice-president general sales, for Thomas Industries.

For the past year Mr. Flynn has been Director of Merchandising for the Benjamin Division.

V. A. Elmblad, Graybar Electric Co., Inc., district manager at Dallas, Texas, recently announced the appointment of **F. B. Murray** as manager at San Antonio, Texas, replacing **R. N. Ness,** who will assume special duties in Dallas. Mr. Murray joined Graybar in 1949.

Multi-Amp Electronic Corp., Union, N. J. has appointed **C. B. Anderson Electric Co.,** 712 Oil Capital Building, Tulsa, Oklahoma, to serve as sales representative in Oklahoma, the Panhandle and southwestern area of Texas, western Arkansas, and southern Kansas.

The Anderson Company will handle Multi-Amp's high-current, low-voltage test units for circuit breakers, relays, reclosers, fuse links and

Killark switch rack components

DESIGNED BY FIELD TESTS . . . PLANT SURVEYS . . . CONSULTATION WITH EXPERTS Here is the complete line of all-aluminum enclosures, completely wired and ready to install . . . designed only after extensive research in the field and consultation with dozens of industries, engineers and consultants, to learn what *you* need and want in this line.

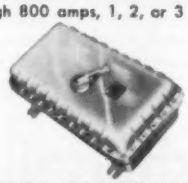
These features are the result: *All-aluminum* for non-magnetic, non-corrosive, lightweight design that offers faster heat dissipation. *Ribbed* for greater strength. *Rectangular design* for easier installation and maintenance, more compact assembly. *Ground surfaces* for tighter fit, no threads to strip. Front operation on all components.

PANEL BOARDS
To your specs, including breaker of your choice. Screw-cover or bolt-on cover, rectangular or "T" wiring trough. Available for hazardous as well as all-weather areas. All seals and connections included.

MOTOR STARTERS

Manual or magnetic, in many forms. Single speed, reversing, two speed, special, and combinations.

CIRCUIT BREAKERS
Through 800 amps, 1, 2, or 3 pole.



DISCONNECT SWITCHES

Fuseable and non-fuseable, up to 200 amps.

CONTROL COMPONENTS—Push button stations, pilot lights, selector switches, contactors, relays, control transformers, lighting transformers, specials.

ILLUSTRATED CATALOG SUPPLEMENT—State your interest.

Killark
ELECTRIC MANUFACTURING CO.
Vandeventer and Easton Aves. • St. Louis 13, Mo.
Sold Through Leading Distributors
WAREHOUSE STOCKS in NINETEEN CITIES in U. S. and CANADA!

transformers also other devices such as transformer-type load boxes meter calibrating equipment, test benches, and units built to customer specifications.

M. C. "Morty" Mason has been appointed representative for the General Electric Supply Co., Miami, according to an announcement by **Charles K. Murphy,** manager of the company.

Mr. Mason will have headquarters at 2510 Florida Ave., West Palm

M. C. Mason

Beach, Fla., serving the Palm Beach area and north to Vero Beach. He has been active in the electrical field in West Palm Beach since 1954, and before that had been associated with the electrical industry of Atlanta, Ga.

Kenneth D. Rose, general manager of Blackhawk Industries, Dubuque, Iowa, since its beginning, was named vice-president at a board of directors meeting recently, it was announced by **Titus B. Schmid,** president.

Mr. Rose has for 25 years served with the company that founded Blackhawk Industries, manufacturers of electrical hardware and fittings.

I. Arnold Hoge Associates has been named to represent Blackhawk Industries in Georgia and Alabama, it was announced recently by **Ken Rose,** vice-president and general manager of the electrical hardware and fittings manufacturer. Hoge Associates are located at 489 Overbrook Dr., N.W. Atlanta, Ga.

C. A. Liming has been promoted to the position of marketing manager —power capacitors for Pacific Electric Co., it has been announced by **R. L. Bobo,** the company's marketing vice-president.

Mr. Liming joined Federal Pacific several months ago as corporate engineering manager—pole line equipment. Previously, he was sales manager of electrical apparatus for Hubbard & Co., Chicago, Ill. Mr. Liming also once headed his own consulting engineering firm in Tulsa, Okla. He received his electrical engineering degree from Purdue University.

G. M. Boyd has been appointed manager - engineering of the Insulator Dept., General Electric Co.,

G. M. Boyd

Baltimore, Md. He succeeds **Howard A. Frey,** now general manager of the Insulator Dept.

Mr. Boyd received his ceramic engineering degree from Virginia Polytechnic Institute in 1943, later returning to receive his M. S. degree in engineering. In 1948 he came with the Insulator Department and served as manager - manufacturing engineering up until his recent appointment.

Warner T. Smith, with over 20 years' experience in various aspects of the telephone, electrification, and electronics industries, has been named chief engineer of Superior Cable Corp., Hickory, N. C. The appointment was recently announced by **J. L. Robb,** president of Superior Cable.

Prior to joining Superior, Mr. Smith was associated with Anaconda Wire and Cable Company. Mr. Smith is a member of AIEE and its wire Communications Committee.

Two executive appointments have recently been made in the Electrical Conductor Div., Kaiser Aluminum & Chemical Sales, Inc., following an announcement by **J. T. Dugall,** division general manager.

J. Carl Ferguson has been named director of electrical conductor marketing and **Cornell C. Maier** succeeds him as division general sales manager.

Mr. Ferguson, a graduate of the Naval Academy in Annapolis, has been with Kaiser for 11 years. Mr. Maier, a graduate of the University of California, has also been with the company 11 years.

James J. Farrell has been named southern regional sales manager of General Electric's Distribution Transformer Dept., according to an announcement by **William R. Smart,** department marketing manager.

He succeeds **James M. McDonald,** who is now marketing manager of the company's Medium Transformer Department.

Mr. Farrell, a graduate of Notre Dame, joined General Electric in 1949.

V. R. Young, Graybar Electric Company, Inc., Gulf Coast district manager at Houston, Texas, recently announced the appointment of **B. G. Draper** as operating manager at Corpus Christi, Texas. Mr. Draper started with Graybar in New Orleans, Louisiana, as a Packer in 1953.

The appointment of **Robert V. Corning** as manager-marketing of the General Electric Company's Large Lamp Dept., located at Nela Park, was announced recently by **Donald D. Scarff,** general manager of the department. Mr. Corning had temporarily been serving in the post during the absence of **Ralph H. Humbert,** whom he now succeeds. Mr. Humbert has suffered prolonged illness. He will remain with the G-E Department as a consultant.

Technical books

for the electrical man

Engineering examinations

"Professional Engineer's Examination Questions and Answers," Second Edition, by William S. LaLonde, Jr., Chairman, Department of Civil Engineering, Newark College of Engineering. Published by McGraw-Hill Book Co., Inc., 327 W. 41st St., New York 36, N. Y., 615 pages, 273 illustrations, $7.50.

This edition of the book is planned to keep pace with the rapidly developing new engineering ideas and procedures represented in recent professional engineer's license examinations.

The questions and answers showing the type of question asked and the kind of answer that examiners accept have been increased by 20 per cent over the previous edition, with ma-

terial authenticated by a man who has acted as a consultant both to examining boards and to individuals preparing for examination.

Over 600 questions selected from recent actual examinations for the Professional Engineer License, the Land Surveyor License, and the Engineer-in-Training Certificate are included in this Second Edition.

The questions cover all major areas of professional engineering examinations. There are questions in fundamental engineering, in chemical, civil electrical, and mechanical engineering. Many are composites of the more complex questions found in professional engineering examinations all over the United States, making the book adaptable for any part of the country where the examination may be taken.

Lighting parking areas

"Recommended Practice for Outdoor Parking Area Lighting," published by the Publications Office, Illuminating Engineering Society, 1860 Broadway, New York 23, N. Y., 8 pages, illustrated, 50¢.

This new edition of lighting practices, which has not been previously published, contributes substantially to the increasing number of guides published by the IES to assist architects, lighting engineers, and specialists in achieving improved lighting. Prepared by IES technical committees, the report is based on new IES recommended levels of illumination, in many instances higher than those in effect for many years.

This guide was compiled in collaboration between the Store Lighting and Roadway Lighting committees to meet the requirements of both groups. Types of outdoor lighting equipment, pole spacing, and mounting heights are all described in detail as are the basic considerations in this type of lighting problem.

Minimum illumination requirements, color, economics, and recommended maintenance are included. Two full pages of photographs of typical outdoor parking area lighting jobs show existing applications.

Electromagnetics

"Electromagnetic Theory and Engineering Applications," by John B. Walsh, assistant director of Electronics Research Laboratories, Columbia Uni. Published by the Ronald Press Co., 15 E. 26th St., New York 10, N. Y., 292 pages, 186 illustrations, $8.50.

This book is a concise, thorough treatment of electromagnetics. Emphasis is on basic concepts, and the engineer's viewpoint is used throughout.

A major purpose of the book is to provide a fundamental understanding of the basis of circuit analysis. It presents the essentials of field theory and then clarifies them further by showing their application to distributed-parameter circuits.

Transmission lines in particular are fully discussed, since they provide one of the simplest and most logical applications of distributed-parameter circuit analysis—the meeting ground of conventional circuit and field analysis.

The discussion of vector analysis is concentrated in a single chapter for easy reference. The rationalized MKS system of units is used throughout.

Subjects covered include elements of vector analysis, electrostatics, the static magnetic field, Maxwell's equations, plane waves, energy flow and guided waves, the relation between field and circuit equations, and transmission lines.

Broadcast engineering

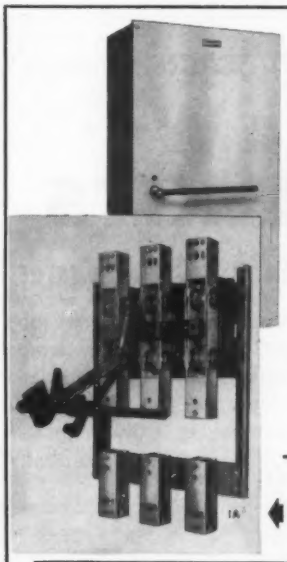
"NAB Engineering Handbook," Fifth Edition, Editor-in-Chief, A. Prose Walker, manager of engineering, National Association of Broadcasters; prepared by staff of specialists. Published by McGraw-Hill Industrial and Business Book Information Service, 327 West 41st St., New York 36, N. Y., 1664 pages, 1306 illustrations, $27.50.

Now fully revised and brought up to date, this new Fifth Edition provides comprehensive reference to latest methods, facts, and data for every phase of radio and television engineering. In it, 47 leading authorities offer quick answers to the full range of design, construction, and operating problems in the broadcasting field.

Antennas, towers, and wave propagation—standard, FM, and TV transmitters — program transmission — studio and remote-pickup facilities—color television facilities — rules, regulations, and standards — these and other major areas of broadcast engineering are covered.

While retaining the same practical approach and method of arrangement which helped establish it as a standard reference in the field, the new and enlarged edition of the handbook offers an entirely fresh view of broadcast engineering.

For example, it describes sweeping developments in such aspects as transistor applications, TV translators and boosters, remote control of transmitters and direction antennas, automatic logging techniques, compatible single-sideband for standard broadcasting, stereophonic broadcasting, video-tape recording, special audio effects, and field strength measurement.



For the Electrical Distributor . . .

the KAM-LOK SWITCH

with pressure contacts

IN AN ALL-ALUMINUM WALL-MOUNTED ENCLOSURE FOR USE WITH AMP-TRAP, BUSSMANN OR G-E CURRENT-LIMITING FUSES

. . . Aluminum enclosure is lighter to handle, more compact and completely free from induction heating

. . . Line and load terminals built-in clamps for up to 4 cables per pole in 1200-4000A sizes — same clamps can be used to facilitate bus bar connections

The open KAM-LOK is also sold to switchboard manufacturers for incorporation in their switchboards

1200-6000A **250 and 480 volts** **3φ3W or 3φ4W**

SALES REPRESENTATIVES THROUGHOUT THE SOUTH
ATLANTA — Edgar E. Dawes & Co., 405 Rhodes Bldg.
(Also Birmingham, Greenville, Tampa, Jacksonville, Cleveland, Tenn.)
DALLAS — Wynne Snoots Co., 2nd Unit Santa Fe Bldg.
(Also Houston, Little Rock, Oklahoma City, Lubbock)
NEW ORLEANS — Associated Manufacturers Agents, 900 Carondelet St.
RICHMOND — Robert W. Fishburne, 1725 Arlington Road (Also Raleigh)
WASHINGTON, D. C. — Rumsey Electric Co., 337 Southern Bldg.

THE KELEK k COMPANY
259 DAVIS AVE. NORWOOD, MASS.

New products

Explosion-proof receptacle

Appleton Electric Co., 1701-1759 Wellington Ave., Chicago 13, Ill. has announced the development of a pendant type exposion-proof receptacle.

This "CPSHC" unit has been specifically designed for ceiling mounting. It entails Appleton's dead-end contact feature which is found in their "CPS" series explosion-proof units. All arcing, if any, is confined within a plug combustion chamber of the dead-end receptacle. Dual protection is afforded the user by the elimination of live contacts exposed to atmospheres which may contain volatile, inflammable, anaesthetical fumes or explosive vapors. Appleton's "CPS" series units have Underwriters' listing for Class I, Groups C and D.

These receptacles have been designed for use with Appleton type "CPP" explosion-proof plugs. To complete the circuit, a simple, one-handed operation is all that is required; plug is inserted as far as it will go . . . rotated ¼ turn to the right . . . and pushed in further until fully seated. The circuit is safely broken by a reversal of this procedure.

Write in No. P-918 on card, pg. 17

Plastic jacketed cable

A plastic jacketed non-metallic sheathed cable is now in production by Triangle Conduit & Cable Co., Triangle and Jersey Avenues, New Brunswick, N. J. Called Thermo-Triex, the new cable represents a major breakthrough in production of a non-metallic sheathed cable, according to the manufacturers.

The individual conductors will continue to be insulated with a polyvinylchloride compound and color coded according to standard industry practice. The outer covering will also consist of a special polyvinylchloride compound which is designed not to deteriorate, making its life limitless. This new outer covering for non-metallic sheathed cable is highly resistant to flame, impact, oil, alkalis and acids. It is free stripping, bright and smooth.

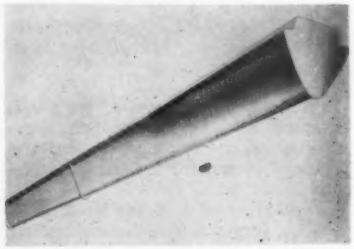
Typical of the many advantages resulting from the new construction are the complete elimination of flaking, greater flexibility, and ease of pulling and stripping. There is no pitch or paint to rub off on hands, clothes or walls. Abrasion resistance is improved 1000 per cent over braided non-metallic cables when run edgewise—100 per cent when run flat. Flame and moisture resistance are improved as well as impact strength and performance on the overload current test. Samples are available from the manufacturer.

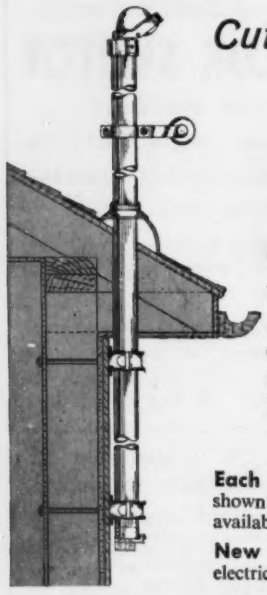
Write in No. P-919 on card, pg. 17

High-level low-cost light

The new "VeeLens" Series fluorescent luminaire by Lighting Product Inc., P. O. Box 338, Highland Park, Ill., provides a low-cost solution to problems incurred in lighting school locker corridors, library stacks, pedestrian tunnels and similar applications.

The VeeLens features a convex reflector and a clear prismatic diffuser containing thousands of 8-sided prisms. The design concentrates high-level light on the vertical wall surfaces yet provides controlled brightness for visual comfort when viewing





Cut Service Entrance Costs!

M & W MAST KITS

Make installations faster, easier

In M&W Kits, there's one just right for every job . . . to fit 1¼ - 1½ - 2 or 2½″ conduit. Split-clamp conduit support or one-hole pipe strap with lag screws. Flashing and adjustable seal. Best of all, M&W Kits cost less than buying individual parts —and you make faster, better, easier installations.

Each kit includes all necessary parts for mast installation shown at left, or as selected for specific needs. Fittings are also available separately.

New Catalog 59 describes and illustrates complete line of electrical fittings and kits. Write for your copy today.

M&W *Electrical Fittings*

The M. & W. ELECTRIC MFG. CO., Inc.

EAST PALESTINE, OHIO

down the corridor. Formerly, only far more expensive fluorescent luminaires with intricate shielding, or incandescent luminaires with special lenses directed the useful light so effectively.

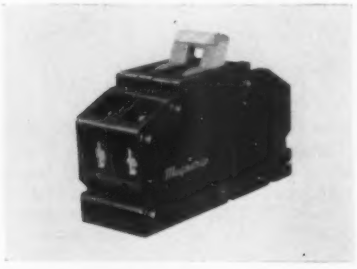
LPI's VeeLens luminaires may be surface or pendant mounted, individually or in continuous rows. Two sizes are available: 4-foot luminaire for one 48-inch 430 ma rapid-start lamp, and 8-foot luminaire for two 48-inch lamps, tandem. Diffusers hinge from either size.

Write in No. P-920 on card, pg. 17

Zinsco circuit breaker

The new Magnetrip 100-ampere circuit breaker, TC100L, has been recently introduced by Zinsco Electrical Products, 729 Tucker St., Los Angeles 12, Calif.

This breaker can be field installed, as a main disconnect or as a submain, and requires only two stand-



ard spaces in the panel. The device has no side lugs. The fact that it can be "plugged-in" and that it can be installed at any point of the panel provides this breaker with features seldom found on breakers.

The 120/240 volt, 2-pole circuit breaker has a common trip, and is interchangeable with all Type T or Q Magnetrip breakers.

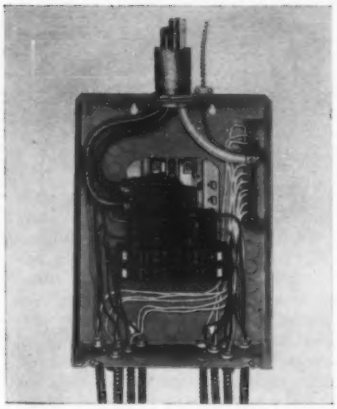
Write in No. P-921 on card, pg. 17

G-E plug-in circuit breaker

New 70- and 100-ampere 2-pole circuit breakers which plug into standard G-E load centers have been announced by the Circuit Protective Devices Dept., General Electric Co., Plainville, Conn.

Suitable for use in G-E "Twin" load centers rated 125 amperes and above, the new breakers are rated 120/240 volts a-c and may be installed either as the main service disconnect or in 200-ampere panels as a branch circuit disconnect. This dual versatility makes possible reduced material costs since the need for a separate main disconnect enclosure is eliminated.

The new devices are designed on a one-inch-per-pole modulus and are therefore interchangeable with all other G-E plug-in circuit breakers. Designated as Type TQAL, the new



breakers are listed by Underwriters' Laboratories, Inc., and feature common-trip action, silver plated current carrying parts and recessed self-aligning spring-reinforced bus receptacles.

Write in No. P-922 on card, pg. 17

Combination meter sockets

A new line of medium duty ring and ringless meter sockets with provisions for field conversion of single or polyphase interiors is now being manufactured by Anchor Manufacturing Co., Bradenton, Fla.

The new series have "Anchor" reinforced copper jaws and 4/0 line and load connectors to meet the constantly increasing electrical requirements.

The large aluminum enclosure is adequate for ease of wiring 4, 5, 6 and 7 terminal sockets.

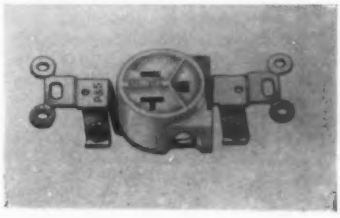
Write in No. P-923 on card, pg. 17

Three-wire grounding outlet

Pass and Seymour, Inc., Syracuse 9, N. Y., has introduced a new single 3-wire grounding outlet, No. 5351, for use on 20-ampere appliance circuits.

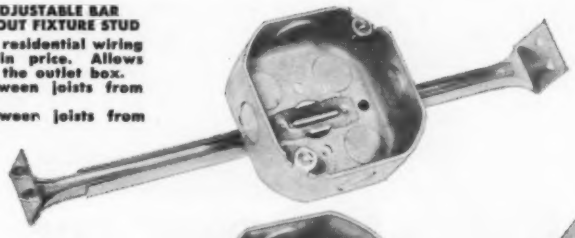
Rated at 20-ampere, 125-volt, the outlet features two easily accessible, green hex grounding screws which permit feed-through of the grounding conductors.

All contacts, including the grounding contact of double grip type. The



BLACKHAWK ADJUSTABLE BAR HANGER WITHOUT FIXTURE STUD

The answer to residential wiring jobs. Lower in price. Allows more room in the outlet box.
562 used between joists from 12" to 18"
563 used between joists from 18" to 26"



BLACKHAWK ADJUSTABLE BAR HANGER WITH FIXTURE STUD

560 used between joists from 12" to 18"
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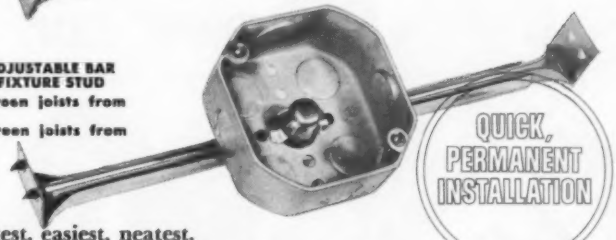
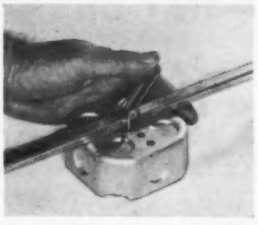


QUICK, PERMANENT INSTALLATION

For the fastest, easiest, neatest, economical way to hang all ceiling light fixtures.

BLACKHAWK ADJUSTABLE BAR HANGER



clips to outlet box—eliminates screw

AVAILABLE WITH OR WITHOUT FIXTURE STUD

Blackhawk Adjustable Bar Hangers are made of heavy gauge steel. Adjustable to required spacing. Support edges of hanger formed to act as plaster gauge. No notching necessary. Blackhawk's exclusive "clipper" saves time and money. No screws to tighten.

Blackhawk Industries

DUBUQUE, IOWA

Where the new ideas come from

contoured design of the outlet face permits easy insertion of cap blades.

Heavy barriers separate contacts of opposite polarity and grounding contacts. Designed for side wiring only, the new outlet has washer-type plaster ears.

Although the device was designed for use with the new NEMA standard 20-ampere, 125-volt grounding cap, it also may be used with 15-ampere, 125-volt grounding caps or regular ungrounded parallel blade caps.

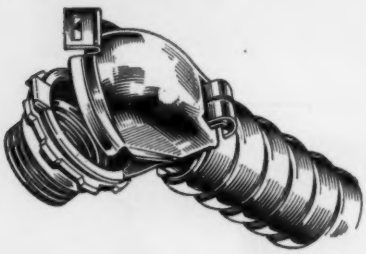
Write in No. P-924 on card, pg. 17

Tomic conduit connectors

Tomic Sales and Engineering Corp., 20,000 Sherwood Ave., Detroit 34, Mich., has introduced two new 90-degree angle Flex-Steel no screw conduit connectors.

These new Tomic connectors, Catalog No. 305—⅜-inch and Catalog No. 306—½-inch are unique no screw units with exclusive hinged snap-caps.

These new Tomic connectors are designed for better, safer, easier, and neater installations. They twist into the Flex and one extra twist locks them in place. They can not shake loose. Positive grounding is assured.



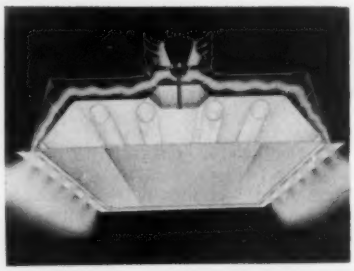
To pull wires through, the cap is flipped open, wires are pulled, and cap is shut. Smooth interior and rounded throat eliminate damage to wires.

Write in No. P-925 on card, pg. 17

Air diffusing lighting unit

Day-Brite Lighting, Inc., St. Louis 15, Mo., and Barber-Colman Company announce a complete line of combination lighting and air diffusing equipment, developed through the combined research facilities of the two companies. The new units are described as "the successful blending of two prime comfort factors, which provide the solution to a growing problem—the competition between acoustical material, air distribution, and lighting elements."

The dual-purpose units are available in both 12 x 48 inch and 24 x 48 inch sizes, with a wide choice of



lighting enclosures including louvers, plastic, and glass.

Combination diffusers eliminate conflicting ceiling placement problems of lighting and air distribution elements.

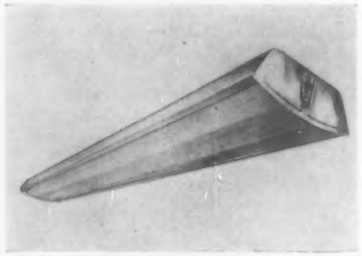
Double wall construction allows air to pass through separate chamber completely isolated from fluorescent lamps. Light output, lamp life, and color are not affected.

Write in No. P-926 on card, pg. 17

Smithcraft lighting fixture

A new lighting fixture combining high quality, rugged construction, low brightness, and low cost, has been introduced by Smithcraft Lighting, Chelsea 50, Mass. The Chelsea, a new plastic-enclosed unit, measures nearly 13 inches wide.

Its clean, trim expanse of plastic eliminates dark metal bands at the



ends of the unit, and offers free-flowing lines in continuous runs. The Chelsea comes equipped with either acrylic or polystyrene shielding. Available in 2, 3, and 4-light units, the Chelsea may be surface-mounted with top reflectors, or pendant-mounted with a high percentage of uplighting.

For continous mounting, a good-sized hole simplifies through-wiring, resulting in easy installation. Anoth-

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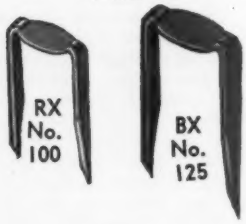


There is a difference- Why take less?

W. W. CROSS & CO. — JAFFREY, N. H. — FASTENERS SINCE 1869

General Sales Agents _____ J. J. WALSH COMPANY _____ Greenville, R. I.

er great time-saver is the patented Smithcraft slide-grip hanger, used for hanging the uplighting units.

Write in No. P-927 on card, pg. 17

Bathroom mirror lighting

To make shaving easier, with better lighting, Dondel Co., Phoenix, Ariz., has introduced a pre-wired adapter unit that adds side lighting to conventional light above bathroom mirror for perfect see-ability in all facial grooming tasks. The unit is designed to connect to existing electric circuit; just remove present top fixture, install patented 3-D frame, then reinstall top fixture. Side fixtures adjust to varying mirror widths.

The outlet in the right fixture arm is convenient for plugging in electric shaver or hair dryer. Translucent panels diffuse incandescent light and combine with rich lustre of silver anodized aluminum to harmonize with any decor.

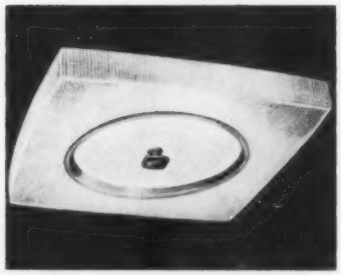
Write in No. P-928 on card, pg. 17

Holophane residential lighting

Holophane Co., Inc., New York 17, N. Y., announces a new two-lens luminaire for kitchen, living room, or, most any home location. It is the first all-purpose indoor residential unit to be offered by Holophane.

The Holophane Company recently announced its entry into the residential lighting field, bringing with it the benefits of more than 60 years of exacting commercial lighting experience. In line with this experience, the new two-lens luminaire is engineered along principles followed in designing lighting equipment to meet the rigid commercial standards.

The rectangular ceiling unit has a circular center lens of "Endural" glass, and an outer or trim lens of acrylic plastic. The inner lens concentrates light on the work or play area directly below, while the outer one comfortably blends illumination for the surrounding area.



In entering the home lighting field, the company has engineered a new series of lights, including three models of a "post-top" unit for outdoor illumination; a two-lens multi-purpose light for indoor use; and several versions of a prismatic "drum type" unit for porches, breezeways, etc.

Write in No. P-929 on card, pg. 17

Progress pendant drops

A trio of pendant drops, fashioned of lovely and world-famed Cordey China, has been introduced by Progress Manufacturing Co., Inc., Philadelphia, Pa. The Cordey Collection offers home decorators flexibility of style, color and mood.

One, two or three light polished brass hangers combined with any of three distinctive pendants, in enchanting designs, brings a fresh approach to lighting of living room, dining room or bedroom. Hung at the same height or staggered, the pendants of the Cordey Collection may be "mixed or matched" for variety of decorator arrangements.

Write in No. P-930 on card, pg. 17

Woodgrain finish wall plates

Bell Electric Co., Chicago, Ill., has recently introduced a new line of handsome woodgrain decorator wall plates in four striking finishes: walnut, maple, birch and limed oak.

The walnut matches many of the mahogany finishes such as Philippine

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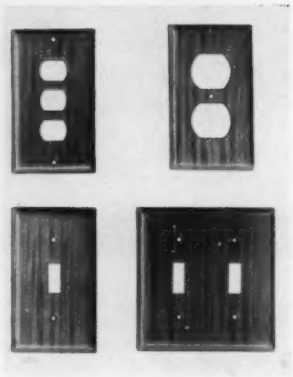


and African mahogany as well as walnut; the maple matches finishes such as cherry, ash, honey pine, etc.; the birch blends with oak, pine, nakora, korina, etc.; and the limed oak harmonizes with many of the pickled finishes.

These plates are ideal for use by the contemporary designer to give a decorative finish to wood paneled rooms such as family rooms, dens, playrooms, kitchens, etc. These are many industrial and commercial applications, as well as uses in house trailers, boats, pre-fab homes and aircraft.

Bell woodgrain wall plates are available in any style desired, such as toggle switch, duplex outlet, or any style needed in from 1 to 10 gangs. Each plate is individually packaged in attractive multi-colored die-cut display sleeve.

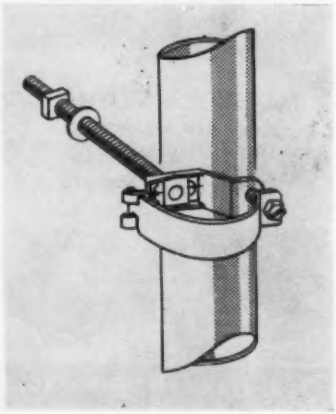
Write in No. P-931 on card, pg. 17

Service mast clamp

A new product, the Adjusto-clamp, has been introduced to the market by Porcelain Products Co., Carey, Ohio, manufacturers of electrical supply items. Designed for use in anchoring service entrance masts to sides of structures the Adjusto-clamp has what the company refers to as "exclusive sideways adjustability" which allows straightening the mast after installation, or aligning mast with meter socket even when the bolt hole is drilled a bit off the vertical. Designed as a split clamp, the new Adjusto-clamp is made of pressed steel and is hot galvanized.

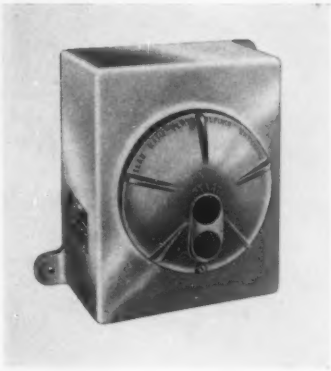
Adjusto-clamps are included as standard items in all 2085 Porcelain Products Mast Kits and are available separately for 2 inch or 2½ inch pipe.

Write in No. P-932 on card, pg. 17



Motor starter housing

An all-aluminum, explosion-proof manual motor starter housing has been announced by Killark Electric Manufacturing Co., St. Louis. Housings in this compact GMMS series are equipped with mounting lugs for convenient installation, and a large screw-type cover for easy access. A set screw on the cover maintains proper alignment of the control buttons with the starter motor. They are front operated. These new housings are suitable for custom hub arrangements.



Write in No. P-933 on card, pg. 17

High-current testing units

Devices to check and maintain proper tripping characteristics of circuit breakers used in industrial plants, commercial buildings, and other applications are now available from Multi-Amp Electronic Corp., Union, N. J.

One such unit designated as Model JR-1 is rated 0.4 kva; Model CB-10 is rated 1 kva. The application of either unit is determined by the current required to test the tripping element whether of the magnetic or thermal type.

Other tests that may be performed are pick-up, reset, and time-current characteristics of circuit breakers of the low-voltage power type and molded-case type.

In addition, other current-actuated devices may be tested, such as CSP transformer breakers, overcurrent relays, fuse links, and small capacity current transformers.

Write in No. P-934 on card, pg. 17

Helpful literature

available to our readers

New Catalog 57-S7 on ASCO accessories and special **control equipment** has just been issued by the **Automatic Switch Co.,** Florham Park, N. J. The new catalog covers break-glass switches, control stations for ASCO mechanically held switches and relays, relay panels for gas valves, engine generator isolating switches, marine duty transfer switches, and phase sequence correctors.

Write in No. B-935 on card, pg. 17

Bulletin GEA-6728, giving information on a new line of **distribution panelboards** with enclosed magnetic starters, has been issued by **General Electric Co.,** Plainville, Conn. The bulletin gives details on panelboards rated 600 volts a-c maximum.

Write in No. B-936 on card, pg. 17

Bulletin 6020, an eight-page brochure covering **Federal Pacific's** new "Fusematic" concept in **switchgear protection,** has been published by the company. Described in the bulletin are the details of why the Fusematic method is considered superior for controlling modern electrical feeder systems in the 600 volt class—when high interrupting capacities are needed.

Write in No. B-937 on card, pg. 17

Complete engineering data on their Plugmold 2100 **all-steel raceway** has been issued by **The Wiremold Co.,** Hartford, Conn. The folder includes revised wire capacity for the raceway recently listed by Underwriters' Laboratories. The illustrated folder contains installation instructions and technical information on devices and fittings.

Write in No. B-938 on card, pg. 17

Information and data on **General Electric's** new general purpose Thymotrol **speed variator,** including details of standard and optional features, are contained in a new bulletin GEA-7018. The eight-page booklet describes the adjustable speed drive which uses the Thyratron tube to convert a-c to d-c power.

Write in No. B-939 on card, pg. 17

A brochure describing the new **aluminum rigid conduit** fabricated by **Harvey Aluminum,** Torrance, Calif., has been published by the company. The publication outlines the advantages of aluminum rigid conduit and specifies the dimensions and weights fabricated. Recommended installation procedures also are defined.

Write in No. B-940 on card, pg. 17

Wheatland Electric "Wheatlanduct" underfloor **raceway systems** is the subject of a new catalog just published for electrical contractors, engineers, and architects by Wheatland Electric Products Co., Pittsburgh. The catalog contains product illustrations and correlated information for correctly specifying and installing Wheatland underfloor ducts and service fittings.

Write in No. B-941 on card, pg. 17

The **Frank Adam Electric Co.,** St. Louis manufacturer of electrical distribution equipment, has announced the publication of three new bulletins on their line of **distribution panelboards.** Bulletin No. 402 covers fusible-type distribution panelboards including both pull-out and hinged cover-operated switches; Bulletin No. 403 describes quick-make, quick-break distribution panelboards using type S-A-W Shutlbrak fusible switches; Bulletin No. 404, features two types of circuit breaker distribution panelboards.

Write in No. B-942 on card, pg. 17

A new 48-page shirt-pocket-size booklet (GED - 3625) describing "Twin" circuit breaker **load centers** and meter socket—load centers is now available from the Circuit Protective Devices Dept., **General Electric Co.,** Plainville, Conn. The two-color publication contains a photograph, wiring diagram and listing of ratings, circuit capacities, and other pertinent ordering information for each catalog number in the G-E line.

Write in No. B-943 on card, pg. 17

Significant economies in installation and operation of a new series of **line tap-off switches** are described in a new bulletin published by the Greensburg Division of **I-T-E Circuit Breaker Co.,** Philadelphia 30, Pa. The 12-page, two-color bulletin illustrates and describes the new line of compact, lightweight Alto switches for one-, two- or three-way switching arrangements in voltage ratings of 34,500 to 69,000 volts and currents of 600 and 1200 amperes.

Write in No. B-944 on card, pg. 17

Bulletin GEA-6832A, 8 pages, from **General Electric Co.,** 1 River Rd., Schenectady 5, N. Y., describes the company's full line of **distribution equipment transformers,** oil and Pyranol filled, rated from 112½ to 2,500 kva, redesigned to be mechanically stronger and 14 per cent lighter than previous models. The bulletin outlines construction details, standard tests and accessories, and switches. Included are tables and diagrams giving electrical and mechanical characteristics.

Write in No. B-945 on card, pg. 17

Through Research TOMIC adds something NEW!

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WHAT'S
NEW
IN
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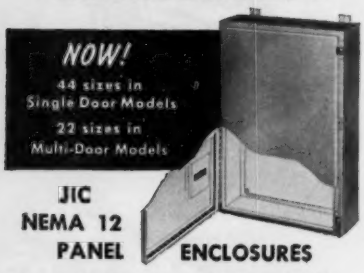
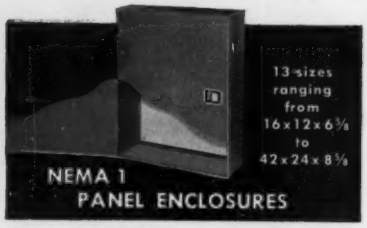
ENCLOSURES?



JIC
NEMA 12
PANEL ENCLOSURES

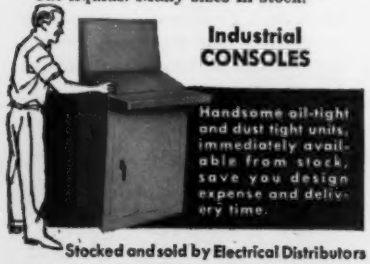
Completely oil-tight and dust-tight. Mounting panel is removable. Standard single door sizes now include many 8" and 10" deep enclosures to accommodate large circuit breakers and disconnect switches. Besides two-door models, we now offer three, four, and five door models up to 15½ feet long. Also available in NEMA Type 4.



A control housing for locations that do not require the oil and dust-tight characteristics of HOFFMAN NEMA Type 12 enclosures. Removable mounting panel. Doors have lift-off hinges and plated "flush" latches.

Oil-tight
time-saving
LAY-IN WIREWAY

This new JIC Sectional Wireway (Patent Pending) offers the "lay-in" feature which simplifies installing wires from control point to equipment. Cover has full length hinge and is gasketed to seal out liquids. Many sizes in stock.



Industrial
CONSOLES

Stocked and sold by Electrical Distributors

Hoffman ENGINEERING CORPORATION

Dept. ES-141, Anoka, Minnesota

Application data for **plug-in-bus duct** is contained in a new 28-page booklet available from the **Westinghouse Electric Corp.** The descriptions, drawings, dimensions, specifications, engineering and test data in the publication give specific information needed to lay out, specify and install this type of bus duct.

Write in No. B-946 on card, pg. 17

Bulletin 22, published by the **Hoffman Engineering Corp.,** Anoka, Minn., describes and illustrates the company's new line of weatherproof **outlets and switches for mobile home parks.** Details on various equipment of this type are included in the 10-page booklet.

Write in No. B-947 on card, pg. 17

Know the law

(Continued from page 111)

ernment a payment bond conditioned upon prompt payment by prime contractor to all persons supplying labor and materials upon government contract, and the prime contractor subcontracted electrical work and materialmen furnished materials to electrical subcontractor pursuant to a series of separate orders received from subcontractor, but there was no entire contract for all materials furnished and subcontractor and materialman did not treat the orders and materials furnished pursuant thereto on a running account basis, materialman was not required to give notice to prime contractor within 90 days from date of last delivery of materials under each separate order and notice given within 90 days from date of delivery of last item to subcontractor was sufficient.

The court said that a contrary interpretation of the Miller Act would lead to absurd results. A laborer in the employ of a subcontractor on a day-to-day basis would be required to serve a notice within 90 days of each day of his employment because each such day of employment would be pursuant to a separate contract. Every material man of every subcontractor who furnished materials pursuant to separate orders, rather than pursuant to one entire contract, would be required to serve separate notices as to each such separate contract, even though the separate contracts were all related to the prosecution of the work provided for in the main contract.

The office of a prime contractor who has undertaken to construct a large public building, such as the Pentagon, for example, might be flooded with 90 day notices from every unpaid day-to-day laborer employed by numerous subcontractors and by every person furnishing materials to numerous subcontractors. The offices of the sureties of such a prime contractor would also be flooded with correspondence and, conceivably, copies of the claims of laborers and material men.

Economic comment

(Continued from page 6)

goods with fairly heavy price tags. It is certainly true that economic conditions can have varying impacts upon the consumer's willingness to buy.

A study of motivational characteristics may also offer the key to how and why a person acts as he does in the face of varying economic conditions. The combination would place business knowledge of the consumer on a thoroughly scientific plane thus removing many of the imponderables that now appear in the selling scene.

Industry today is moving in this direction. However, increased applications of the knowledge gained should be applied to all segments of the business picture—from production through distribution to the consumer. This may well be a controlling force in the future success of American business.

Wire puller

(Continued from page 47)

it," offered one of Mr. Carpenter's electricians at a demonstration. Mr. Carpenter has, however, one or two small refinements in mind. He is considering use of a roller at the top of the bracket arms, for a more even feed of wire to the spool. And he is also considering the addition of a reversible switch for backing off the load.

He recently applied for, and got, a patent on the device (No. 2,896,-911) and has under consideration proposals to manufacture the device.

Conductor heat

(Continued from page 104)

plotted on Figures 6 and 7 were derived from equations (2) and (4). The current carrying capacities in amperes plotted on Figure 8 were derived from (3) and apply to standard annealed copper, 100 per cent conductivity. To obtain the current carrying capacity for copper of other conductivities, or

aluminum, multiply the value read from a given curve by the value in Table 4 corresponding to the conductivity. For aluminum multiply also by 0.78.

Westinghouse meter

(Continued from page 96)

developed epoxy base Epodur enamel and a single metal system register and cover rim, both further protected by a highly corrosion resistant chromate conversion coating.

The polyester insulations are extremely stable with negligible "throw-out" or deterioration even at extreme temperatures and environments. Voltage withstand levels exceed 10,000 surge volts or well above the 4000-5000 breakover levels of the De-ion surge flashover arrestors incorporated outside the base.

The design of the Magnethrust meter has been one of co-ordinating all the desirable characteristics and stabilities of a watt-hour meter into one finished product—one which should prove to be another definite milestone towards the goal of more economic revenue metering.

Since it is used for all equipment in the line of D2S watt-hour meters, the new Magnethrust bearing will be available in meters with voltage ratings of 120, 240, 480, or 600 volts and current ratings of 2.5, 15, or 30 test amperes. All meters in the line are designed to accommodate loads up to 667 per cent of meter rating.

Sangamo meter

(Continued from page 94)

teristics of the flotation magnets, damping magnets and electromagnets. Repeated tests of this nature and other surge and short-circuit tests have indicated more than adequate immunity to extraneous high magnetic fields.

Other components of the moving system consist of graphite guide rings, pivots, and Delrin thrust plates located at both ends of the disk spindle. The pivot material is the same as that used for the ball bearing in the J2 meters—Cobenium—chosen for its excellent wear characteristic coupled with corrosion resistance and non-magnetic properties.

By virtue of the Delrin thrust plates and adjustable pivots, upper and lower endshake is controllable. Clearances between the end of each pivot and the thrust plates are factory set at 0.008 inch. The ability to control upper and lower endshake limits vertical disk movement, thereby providing protection against temporary overloads or severe handling conditions. It also enables removal and exact replacement of the disk in the field.

The dual pairs of Alnico damping magnets are inserted into cavities located on each side of the redesigned, die-cast aluminum frame. The individual magnets with their associated temperature compensator are incased in an aluminum wrapper and are machine pressed into the die-cast cavities. Accelerated environmental test results have indicated excellent mechanical and magnetic stability of the anchoring method used.

This arrangement results in an approximate 50 per cent decrease in side thrust upon the moving system, subsequently providing increased stability of registration for long periods of time. A further reduction of the effects of side tarust has been achieved with the positioning of the graphite guide rings, which equalizes side thrust on the rings as closely as possible, but which is still consistent with over-all physical design. Lower and upper rings carry 60 and 40 per cent, respectively, of the resultant side thrust.

Due to the proved thermal and insulation characteristics of epoxy coated current coils in Sangamo polyphase meters, this process was adopted for J3 meters. The epoxy coated current coils achieve efficient heat dissipation and provide high insulation between the current coil winding and the lamination stack, and between turns. Nylon insulators are now used on the current electromagnet to prevent physical damage to the epoxy with the added benefit of additional insulation protection. Insulation level of the current electromagnet is 10 kv rms.

A new polyethylene cover gasket is located in the meter base. The gasket along with the use of newly designed spring-tempered lugs on the stainless steel cover ring provides a positive dust-tight seal for the life of the meter. The unique feature of the spring lug design is that the lugs will flex sufficiently to always provide a satisfactory seal independent of

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For the finest in friction, rubber or plastic tape, always look to ACCURATE . . . suppliers of "your best buy in tape."

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ELECTRICAL
ESTIMATING GUIDE

Covers Over 2000 Wiring Jobs
This new, entirely different estimating guide has 200 completely worked out charts.

Authentic, Time Saving—Easy to Use
This book is easy to use—it has no complicated mathematics or formulas to work over. You merely determine the nature of the wiring, check it in the BLUE BOOK OF ELECTRICAL ESTIMATING and there's your answer—it's the simplest estimating book ever written.

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For a limited time the publishers offer a copy of the latest National Electrical Code book for just examining the new Blue Book of Electrical Estimating.
This book was written by a successful electrical contractor and estimating engineer with over 20 years' experience. It has an entirely different method of determining estimates on wiring jobs. Electrical contractors, journeymen, architects, and engineers will find use for this book every day. Gives time required to do jobs along with complete labor charges in every state in the country. Check the PRODUCTIVITY of your men with this authentic, field tested book. Order this book now from your supplier at special introductory price of $8.25 or send coupon below.

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(September 1960)

any dimensional changes that may occur in the gasket. In fact, the cover fits tightly even if the gasket is removed from the meter base.

The new frame design made it possible to reduce the over-all height of the J3 approximately ½ inch.

The new Sangamo J3 is an integrated design involving new concepts, yet retaining field proved and accepted features of the superseded J2. Test results obtained prior to full factory production are being further substantiated with "in service" and shipping tests of production run meters. Initial accuracy has been exceptional and accelerated life tests give every indication that no appreciable change of registration will take place during the life of the meter, indicating the prime design criteria of sustained accuracy has been achieved in the J3.

Cluster mounting

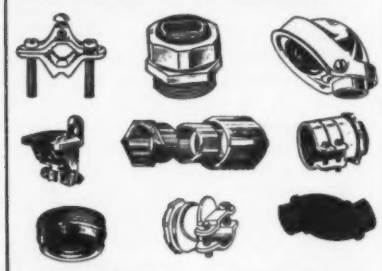
(Continued from page 93)

be moved intact to the location and placed in the hands of the line crew who may raise it to the proper location on the pole and secure it in position (See Fig. 3). This method of assembly affords us several advantages over the old method by which we placed our components on the pole unit by unit, and gave the workman atop pole proper directions for making all connections.

The shop assembly method eliminates this procedure and gives us, at the same time, ease of assembly and positive check of all connections. Another advantage of a compact unit of this nature is that it lends itself readily to the standards used for high voltage line construction. This feature is further substantiated by the fact that the equipment here described was mounted on a buck arm pole which, due to space limitations, would not lend itself readily to installation of equipment not so compactly assembled.

It was pointed out that shop assembly time could be held to a minimum of four man hours using meter shop personnel. As for time of installation on pole, this writer was on job site during the period of installation and one and one-half hours were spent in raising the assembly to location on pole and making high voltage connection by the line crew, who were at the time in process of building a 12-kv line to the customer.

ELLIOTT'S COMPLETE LINE OF CONDUIT FITTINGS



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Sample testing

(Continued from page 90)

The variables plans offer excellent applications in watthour meter accuracy control where the cost of test is relatively high, the expected per cent defective is low, and small samples are generally desirous. The latter can be especially true in the case of the smaller utility that might not be able to justify a sample testing program under an attributes plan. Samples of even 50 or 100 units can give adequate results for many applications. It is not proposed that a universe sample size be limited to such quantities, but in stratification, a sample of this size is often adequate and should be explored thoroughly when designing a plan.

To demonstrate this the 29,713 meters shown in Figure 3 were considered a universe and small samples were randomly withdrawn. Since the bar-X and sigma of the universe are known, actual sample results can be compared with those obtained from the theory.

First, twenty-five random samples of 50 meters each were drawn and the bar-X or mean of each sample is plotted as a small black dot in Figure 3 (lower center). It can be seen that they not only accurately describe the true mean, but they, too, tend to form a small normal curve about the mean. The sigma for this curve is known as the standard error of the mean and is shown as sigma sub bar-X $=\sigma/\sqrt{n}$. Similarly, the standard error of the standard deviation is shown by sigma sub sigma $= \sigma/\sqrt{2n}$. As one would expect, only a slight improvement in prediction can be gained by increasing the sample above 200 for a variables plan due to the $\sqrt{n}$ and the $\sqrt{2n}$ in the denominators of the standard error terms. In this test all sample sizes correlated well with the theory and even the small sample size of 25 meters gave quite accurate results.

"OC" curves

An important part of any sampling plan, variable or attribute, is its "OC" or operating characteristic curve which describes just what the plan will do for you. Figure 4 shows a family of single sample variables plans for sample sizes of 10, 20, 50, 100, and 200. This family is for 1% AQL (acceptable quality level) and it should be noted that all the curves of this group pass through 95%

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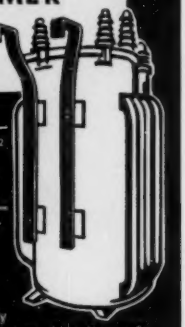

MODEL	C-1	C-3
Transformer	75-100 KVA Single-Phase	75-112½ KVA Three-Phase
Weight	46 lbs.	100 lbs.

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assurance for the 1% AQL. This means that if lots 1% defective are continuously submitted to these plans, they will accept 95% of the lots.

The second point that helps describe the curve is the LTPD (lot tolerance per cent defective) and is generally shown at 10%. It can be seen as the sample size increases, the LTPD approaches the 1% AQL. For a sample of 100, lots 3.5% defective would be accepted 10% of the time and lots 5% defective would be accepted only 1% of the time, or rejected 99% of the time. An important feature in sampling a group or system of meters is that if a lot 3.5% defective were accepted this year, its chances of being accepted two consecutive years would be:

$$10\% \times 10\% = 0.1 \times 0.1$$
$$= 0.01 \text{ or } 1\%$$

Similarly, it has only a 0.1% chance of being accepted three consecutive years.

The past decade has seen statistical evaluation take a firm foothold in the meter industry both for the manufacturer and the utility. We are finding out as we become more familiar with these techniques that their use is not limited to just meter performance but can be extended to associated areas and fields. The next decade may well show that many other 100% tasks in our businesses today may be replaced with an accurate statistical sample.

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Formula for growth

(Continued from page 43)

is sold, and thus avoid future headaches to the builder.

"We get to the job whenever the builder is ready for us; we do the work and we get out," says Mr. Cranmer.

"For example, a tile man may create problems for us as well as the builder when he sets tile higher than we anticipated. There may be time-wasting bugaboos in relocating switches and receptacles where such tiles end and plaster begins in bathrooms. We check out kitchen sink backsplash walls to make sure receptacles aren't too low and partially concealed; and we watch out for correct meter and panel locations and heights which are important.

"And the builder knows that when he sells his house, we'll answer to his customer. We want the customer to seek us out—not the builder—if he has any complaint. It is our aim to keep the customer off the builder's back. That's mighty important to the building contractor because complaints and inattention to them directly affect his reputation."

This attitude explains why the Cranmer firm wires so many custom-built homes where the wiring jobs with fixtures and electric heat total $2,000 and more. And it is the reason why the firm aggressively seeks the jobs in homes selling from $12,000 on up to $60,000.

Mr. Cranmer explains his preference for quality-home wiring: "On project homes, competition and cut-pricing is so frantic, there's mighty little profit in them.

"On the other hand, when you're wiring $50,000 homes, and each job is different from the last, you have a chance to use your ingenuity. And because you never wire the same kind of house in exact duplicate, the wiring of custom-built houses tends to develop better electricians."

Sales promotion plans

To woo new customers, the Cranmer firm resorts to a well planned sales program in which the builder is shown the savings he can achieve through doing business with Cranmer. The new customer is shown the firm's records to substantiate this claim; he is assured all calls or appointments will be handled the very same day they're made.

Sales kits carried by salesmen-estimators contain a full complement of spec sheets, heat data, lists of satisfied customers, prices, and 5 or 6 lines of fixtures.

"Our aim in seeking business is two-fold," says Cranmer. "We're not interested in quantity and prefer doing jobs where quality is appreciated. By the same token, we go after the builders who have the reputation of being live wires."

Obviously these men demand performance, besides the savings tendered by Cranmer. Which means the electrical contractor who merits their confidence—and business—must operate at top-level efficiency.

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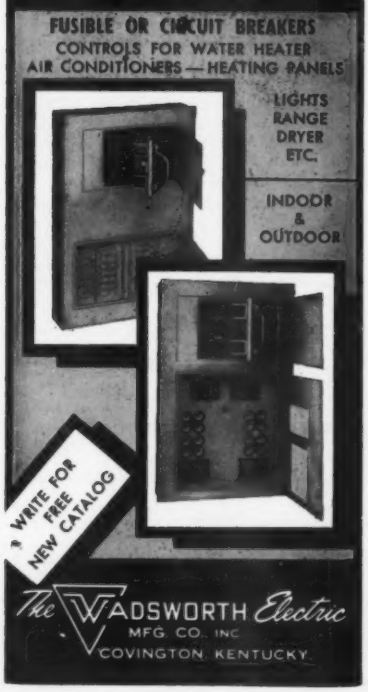

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this takes the form of supervision and service—in that order. To avoid argument, for example, Cranmer's records include a file which indicates at a glance why the heating inspection hasn't been made, the date Cranmer turned it in, who was contacted, permits, etc.

"Heating inspections here are separate from wiring inspections, and nothing irks a builder more than to be held up by something of that kind. We keep careful records of such details, for if there are delays we want the builder to know that we are not responsible." Mr. Cranmer says, "Record-keeping is vital to maintaining goodwill. For instance, a city release is required before the electric utility will turn on the power. Forget it, and the customer will sit in a dark home, brooding about how he'll haul the builder over the coals for the neglect! We can't afford to let such vexations reach our customers."

Small wonder that one builder has said of Cranmer: "I can beat your prices, maybe, but I sure can't beat your service!"

Wiring prefabs

(Continued from page 39)

in units. The prefab type, however, goes up much faster, and the entire wiring job can be done in almost a continuous process. This means the contractor completes his job faster.

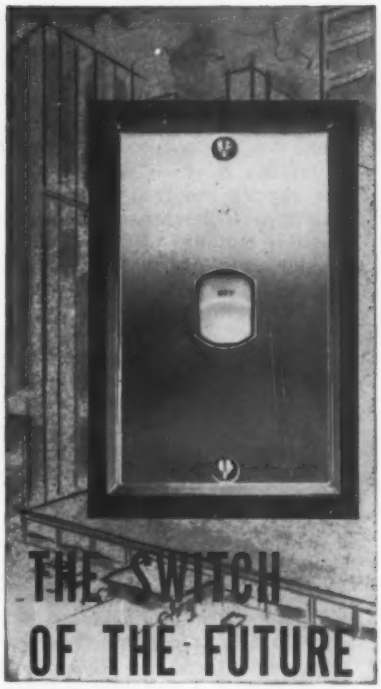
In addition to the time saved, the relatively standard designs of prefabs make it possible to figure labor costs more accurately than is usually possible on conventional buildings.

All-concrete house

(Continued from page 37)

The contractor cautions estimators that the wiring is definitely harder to visualize. Special care should be taken to pinpoint just how many connections, adapters and couplings are needed from conduit to greenfield; and variations on depths of wall and use of back-to-back outlets must be considered. Work must be co-ordinated with building crew as the house progresses.

Further refinements are expected as construction methods move to all pre-cast foam concrete walls (Betocel). Mr. Atherton believes use of magnesium-packed copper tube cables (Type MI) may be the



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answer. Although this material is a little more expensive, he points out that the fittings, just like copper plumbing, would be time-saving, as would other labor costs. And although no moisture or condensation problem has been encountered in these houses, use of the copper material would offer still greater insurance against any possible trouble.

Appraisers have pointed out the houses are not "faddish"; that the design is simple and durable.

Architect Conner stresses this simplicity, in design and building. The prime requisite, he says, is careful structural design, not costly skills in the field. The shell roof is formed with straight lumber, poured on plyboard surface in two hours with a crane.

Decorative advantage

The houses offer many advantages for the buyer. Roof design is capable of great variation, from conservative to dramatic. Interior arrangement can be almost anything desired. Color may be almost any shade desired by the use of aggregate or marble chip on the walls, or even colored tile. Or the entire house may be painted quickly with a roller.

On a house with 1,500 feet of living space under the roof, including 250 for the garage, with three bedrooms, bath and a three-quarter bath, FHA has given an existing appraisal of $15,000. Prices in the development of these houses are to run from $14,000 to $16,000. While these costs are similar to conventional houses of like space, some buyers are able to "upgrade" themselves to these houses on the basis of lessened insurance cost alone. This cost of only 85 cents a month makes the monthly payments less, not to mention other savings projected over the years.

It seems likely that more and more electrical contractors will add this new kind of home to their building vocabulary.

Time-savers

(Continued from page 35)

unreeled from a single reel instead of four.

A luminous ceiling of 100,000-watt of illumination in the International Conference Room, which measured 90 feet x 100 feet, was assembled from thousands of parts. However, this was a task that precluded the employment of any time-saving devices, according to Mr. McMahon.

Washington news

(Continued from page 8)

branded illegal by a trial examiner for the National Labor Relations Board.

The secondary boycott halted work from March 16 to April 29, the trial examiner said. He recommended that the Labor Board issue a permanent ban against the work stoppage.

An IBEW picket carried a sign reading: "Melson Construction Co. does not employ members of or have a contract with Local Union 429 I. B. E. W. (W. D. Robinson) LU 456."

After the picket appeared, the six ironworkers and the two operating engineers quit the job, the three glaziers left work, motor crane drivers and operators refused to work, building supply drivers refused to deliver, a Dixie-Ohio Express trucker would not deliver goods, and a Hoover Motor Express driver also refused.

The picketing ended April 29, after the Labor Board sought a temporary injunction.

The IBEW told the trial examiner that it picketed because Melson paid electricians $1 to $1.50 an hour compared with the union rate of $3.42 an hour. The trial examiner rejected the union's statement. He wrote: "The unrefuted testimony of Sam M. Melson . . . reveals that the electrician then on the . . . job was paid at the rate of $3 per hour and that other electricians in Melson's employ receive $3.65 to $4 per hour."

The trial examiner found that the IBEW was trying to force Melson to employ union members and sign a union contract. He said this was illegal since Melson's electricians had never chosen the IBEW to represent them.

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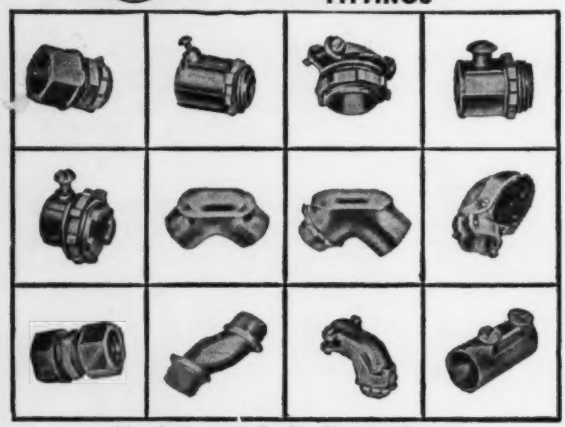

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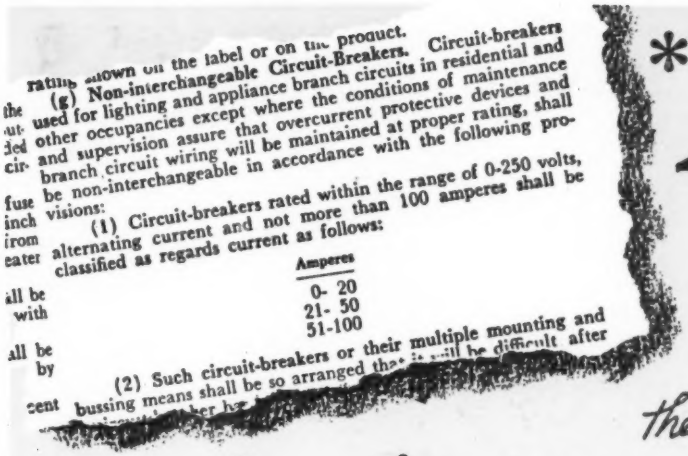
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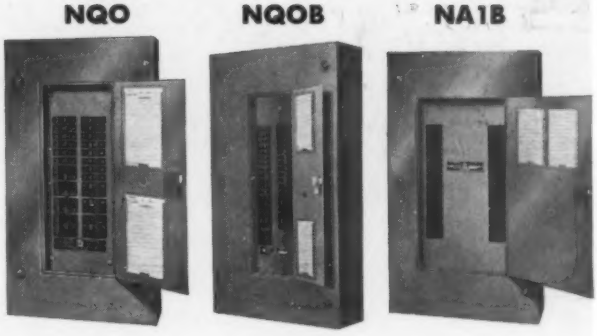

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